Agilent 1200 Infinity Series Multisamplers

User Manual

Agilent Technologies

Notices

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CAUTION

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In This Guide

This manual covers the following modules:

- Agilent 1290 Infinity II Multisampler (G7167B)
- Agilent 1260 Infinity Multisampler (G7167A)

1 Introduction

This chapter gives an introduction to the Multisampler.

2 Site Requirements and Specifications

This chapter provides information on environmental requirements, physical and performance specifications.

3 Using the Module

This chapter explains the essential operational parameters of the module.

4 Preparing the module

This chapter explains the operational parameters of the module.

5 Optimizing Performance

This chapter gives hints on how to optimize the performance or use additional devices.

6 Troubleshooting and Diagnostics

This chapter gives an overview about the troubleshooting and diagnostic features and the different user interfaces.

7 Error Information

This chapter describes the meaning of error messages, and provides information on probable causes and suggested actions how to recover from error conditions.

8 Test Functions and Calibration

This chapter describes the built in test functions.

9 Maintenance

This chapter describes the maintenance of the Multisampler

10 Parts for Maintenance and Upgrade or Options

This chapter provides information on parts material required for the module.

11 Identifying Cables

This chapter provides information on cables used with the modules.

12 Hardware Information

This chapter describes the module in more detail on hardware and electronics.

13 LAN Configuration

This chapter provides information on connecting the detector to the Agilent ChemStation PC.

14 Appendix

This chapter provides addition information on safety, legal and web.

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1 Introduction

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This chapter gives an introduction to the Multisampler.

Product Description (G7167B)

The Agilent 1290 Infinity II Multisampler can handle both vials and microtiter plates with ease and efficiency up to 1300 bar system pressure, optimized on chromatographic performance.

In fact, this compact module has the capacity to house up to 6144 samples, all inside the Agilent stack footprint and the robotics to smoothly inject each into the chromatograph in turn.

With the multi-wash capability, you can reduce carryover to less than 9 parts per million.

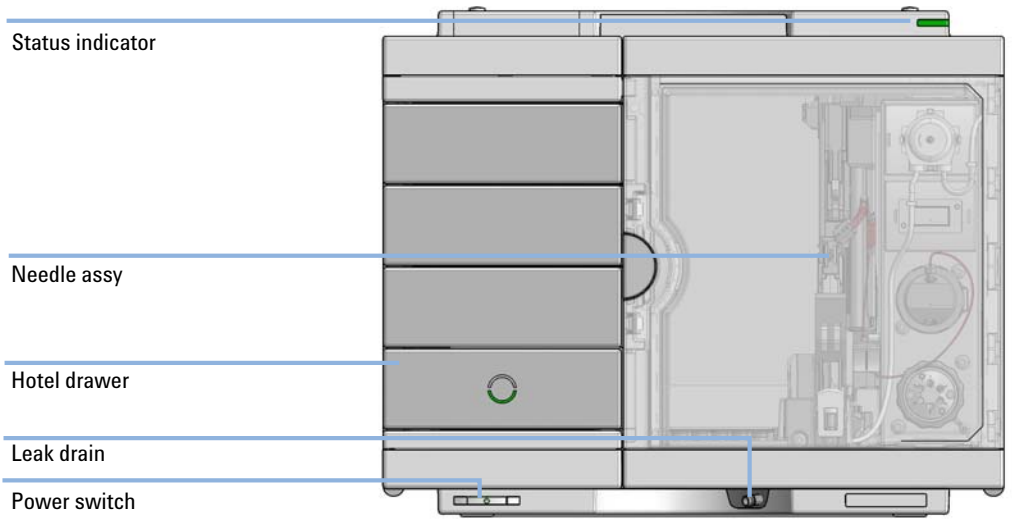

Figure 1 Overview of the Multisampler

Product Description (G7167A)

The Agilent 1260 Infinity Multisampler can handle both vials and microtiter plates with ease and efficiency up to 600 bar system pressure, optimized on high flexibility.

This compact module can house up to 6144 samples, all inside the Agilent stack footprint and the robotics to inject each into the chromatograph in turn.

With the multi-wash capability, you can reduce carryover to less than 9 parts per million.

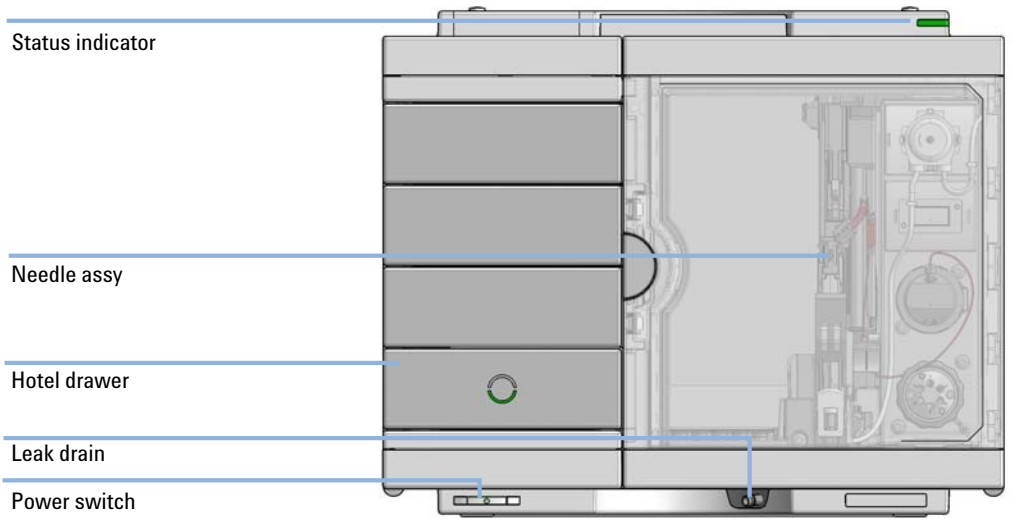

Figure 2 Overview of the Multisampler

Features (G7167B)

- *Unmatched flexibility* – You choose how you want to introduce samples for injection, whether you prefer vials, microtiter plates, or any combination of formats. Sample drawers are available in three heights, and you can mix shallow drawers with deeper ones to accommodate different sample sizes.
- *High capacity* – Using shallow well-plate drawers, the 1290 Infinity II Multisampler takes a maximum load of 16 microtiter plates and up to 6144 samples—the most of any single system.
- *Seamless automation* – Internal robotics move microtiter plates and other sample containers from the sample hotel to the central workspace for sample processing steps and injections.
- *Dual-needle injection* – By running samples alternately through one or the other injection path, you can reduce cycle times to mere seconds, virtually eliminating conventional wait times—whether for large volume loadings or flushing procedures.
- *Scalable injection volumes* – The Agilent unique dual-needle integ setup also enhances flexibility by providing two differently optimized injectors in a single instrument. You can, for example, optimize one path for large volume injections and the other for low delay volumes.
- *Ultralow carryover* – The 1290 Infinity II Multisampler is designed for low carryover, but you can take clean to a whole new level with our multi-wash capability, cleansing all relevant injection parts between runs. This sophisticated, integrated feature flushes the injection needle outside with three solvents, and uses seat backflush procedures to reduce carryover to less than 10 ppm.
- *Efficient temperature control* – For temperature-sensitive samples, simply add Agilent's new highly efficient compressor-based cooling system. It allows you to maintain perfect temperature control on all vials and plates inserted into the 1290 Infinity Multisampler.
- *Instant information* – Lights on each drawer tell you all you need to know about loading status, current activity, and accessibility.

Features (G7167A)

- *Unmatched flexibility* – You can choose how you want to introduce samples for injection, whether you prefer vials, microtiter plates, or any combination of formats. Sample drawers are available in three heights, and you can mix shallow drawers with deeper ones to accommodate different sample sizes.
- *High capacity* – Using shallow well-plate drawers, the 1260 Infinity Multisampler takes a maximum load of 16 microtiter plates and up to 6144 samples—the most of any single system.
- *Seamless automation* – Internal robotics move microtiter plates and other sample containers from the sample hotel to the central workspace for sample processing steps and injections.
- *Dual-needle injection* – By running samples alternately through one or the other injection path, you can reduce cycle times to mere seconds, virtually eliminating conventional wait times—whether for large volume loadings or flushing procedures.
- *Scalable injection volumes* – The Agilent dual-needle setup enhances flexibility by providing two differently optimized injectors in a single instrument. You can, for example, optimize one path for large volume injections and the other for low delay volumes.
- *Ultralow carryover* – The 1260 Infinity Multisampler has a low carryover, and a multi-wash capability, cleansing all relevant injection parts between runs. This integrated feature flushes the injection needle outside with three solvents, and uses seat backflush procedures to reduce carryover to less than 9 ppm.
- *Efficient temperature control* – For temperature-sensitive samples, add Agilent's compressor-based cooling system. It maintains temperature control on all vials and plates inserted into the 1260 Infinity Multisampler.
- *Instant information* – Lights on each drawer tell you about loading status, current activity, and accessibility.

Overview of the Module

The Multisampler transport mechanism uses a Cartesian robot. The X-Y drive together with the Z drive optimize the grabbing and positioning for the sample trays and the needle handling inside of the Multisampler. The sample coupler moves the sample container from the sample hotel which stores all the samples and place it on the central workspace. Then the needle coupler of the Z drive takes over and grabs the needle assembly from the needle station and performs the analytical procedures inside of the Multisampler. Due to Due the uncoupled needle design, the robot can do other liquid handling jobs during the analysis.

The multisampler employs an active vial/plate pusher mechanism to hold down the vial or the plate while the needle is drawn back from the sample vessel (a must in the case a septum is used). This active vial/plate pusher employs a sensor to detect the presence of a plate and to ensure accurate movement regardless of plate used. All axes of the transport mechanism are driven by very fast BLCD motors. Optical encoders ensure the correct operation of the movement.

The standard configuration of the Multisampler uses either a 40 µL or a 100 µL metering device. With this instrument setup, it is possible to inject a maximum volume of 20 µL or 100 µL. For higher injection volumes, additional hardware modifications are required. For minimum internal carry-over, the entire injection flowpath is always flushed by the mobile phase.

In addition, you have two different possibilities to reduce the carry-over. First the external needle wash. In the Standard configuration, the needle flush station is equipped with a peristaltic pump to wash the outside of the needle. This reduces the already low carry-over for very sensitive analysis. The bottle containing the mobile phase for the wash procedure will be located in the solvent bottle cabinet. Produced waste during this operation is channeled safely away through a waste drain. In the Multi-Wash configuration, the external needle wash will be done by a micro piezo pump combined with a solvent selection valve, where you can select between three different solvents. If this is not sufficient to reduce the carry over, there is an additional and perfect way to achieve the lowest carry over in the Multi-Wash configuration by using the integrated

flush pump. This high-pressure pump can also select between three different solvents and is capable of reducing the carry over to a minimum by using the seat backflushing. The flush pump outlet capillary is connected to port 4 of the Multisampler's injection valve, which normally holds the waste line. If the Multisampler is in bypass mode, the flush pump connects to the needle seat and can flush backwards through the needle seat into the waste line attached to the needle seat outlet port.

The six-port (only 5 ports are used) injection valve unit is driven by a high-speed hybrid stepper motor. During the sampling sequence, the valve unit bypasses the Multisampler, and connects flow from the pump to the column directly. During injection and analysis, the valve unit directs the flow through the Multisampler which ensures that all of the sample is injected onto the column, and that the metering unit and needle are always free of sample residue before the next sampling sequence begins.

The Cooling Control of the vial/plate temperature in the Multisampler is achieved using an additional Agilent Sample Cooler module. The sample cooler is a micro compressor-based refrigerator. A fan draws air from the central workstation above the sample container of the Multisampler. It is then blown through the fins of the cooling module, where it is cooled according to the temperature setting. The cooled air enters the Sampler Hotel through a recess underneath the special designed base plate. The air is then distributed evenly through the Sample Hotel ensuring effective temperature control, regardless of how many sample containers are in the drawer. In cooling mode, condensation is generated on the cooled side of the Sample Cooler. This condensed water is safely guided into a waste bottle for condensed water that is located underneath the working bench.

Standard Single Needle Setup

The movements of the Multisampler components during the sampling sequence are monitored continuously by the Multisampler processor. The processor defines specific time windows and mechanical ranges for each movement. If a specific step of the sampling sequence is not completed successfully, an error message is generated. Solvent is bypassed from the Multisampler by the injection valve during the sampling sequence. After the required sample container was automatically loaded from the sample hotel and placed on the central workspace. The Needle assembly moves via robot to the desired sample position and is lowered into the sample liquid in the sample to allow the metering device to draw up the desired volume by moving its plunger back a certain distance. The needle assembly is then raised again and moved to the needle park station onto the seat to close the sample loop. Sample is applied to the column when the injection valve returns to the mainpass position at the end of the sampling sequence.

The standard sampling sequence occurs in the following order:

1 The robot loads the required sample container on the central workspace
2 The injection valve switches to the bypass position.
3 The plunger of the metering device moves to the initialization position.
4 The robot couples into the needle assembly from the needle parkstation.
5 The robot unlocks the needle assembly and moves up.
6 The coupled needle assembly/robot moves to the desired sample vial (or well plate) position on the central workstation.
7 The needle lowers into the sample vial (or well plate).
8 The metering device draws the preset sample volume.
9 The needle lifts out of the sample vial (or well plate).
10 The coupled needle assembly/robot is then moved to the park station onto the seat to close the sample loop.
11 The needle assembly is locked into the park station and moves down.
12 The injection cycle is completed when the injection valve switches to the mainpass position.

13 The robot moves the sample container back into the sample hotel if the sampling sequence is done. If needle wash is required it will be done between step 9 and 10.

NOTE

For the needle seat backflush the Multisampler must be in bypass mode.

If an additional needle seat backflush is required this step must also be done between step 9 and 10.

Injection Sequences

Injection Sequence for single needle

Before the start of the injection sequence, and during an analysis, the injection valve is in the mainpass position. In this position, the mobile phase flows through the Multisampler metering device, sample loop, and needle, ensuring all parts in contact with sample are flushed during the run, thus minimizing carry-over.

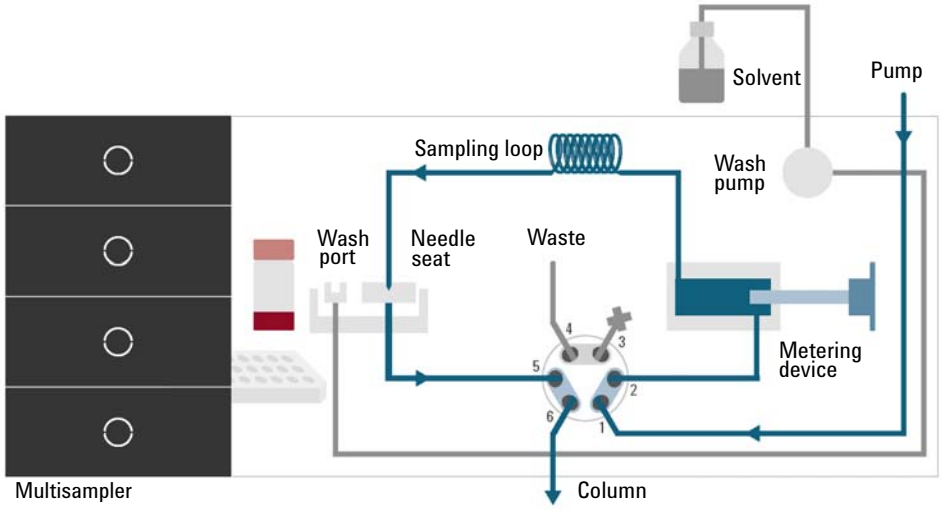

Figure 3 Valve in mainpass, flow through

When the sample sequence begins, the valve unit switches to the bypass position. Solvent from the pump enters the valve unit at port 1, and flows directly to the column through port 6.

The standard injection starts with draw sample from vial/wellplate from the central workstation. In order to do this the needle assembly moves via robot to the desired sample position and is lowered into the sample liquid in the sample to allow the metering device to draw up the desired volume by moving its plunger back a certain distance. The needle assembly is then raised again and moved to the needle park station onto the seat to close the sample loop. In case of an injector program several steps are interspersed at this point.

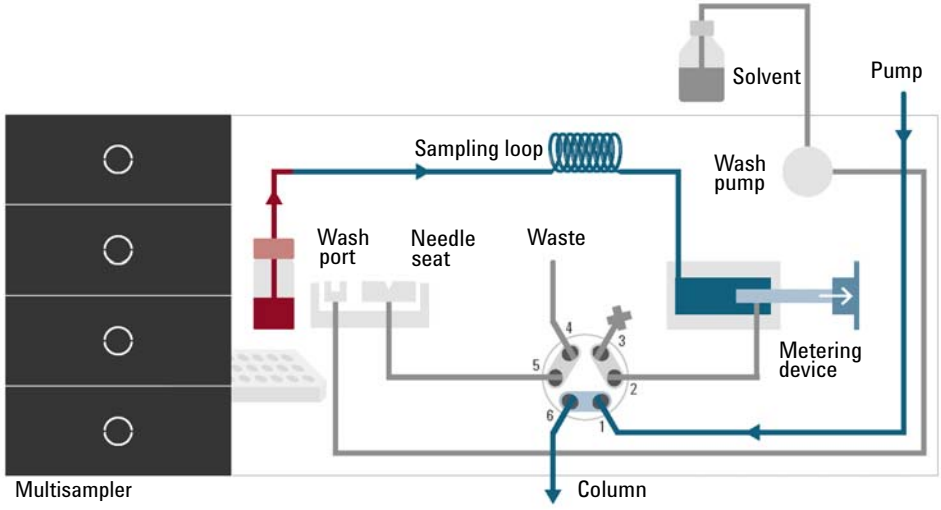

Figure 4 Valve in bypass, drawing sample

Flush the Needle

Before injection and to reduce the carry-over for very sensitive analysis, the outside of the needle can be washed in a flush port located behind the injector port. As soon as the needle is on the flush port a wash pump delivers some solvent during a defined time to clean the outside of the needle. At the end of this process the needle assembly returns to the needle port.

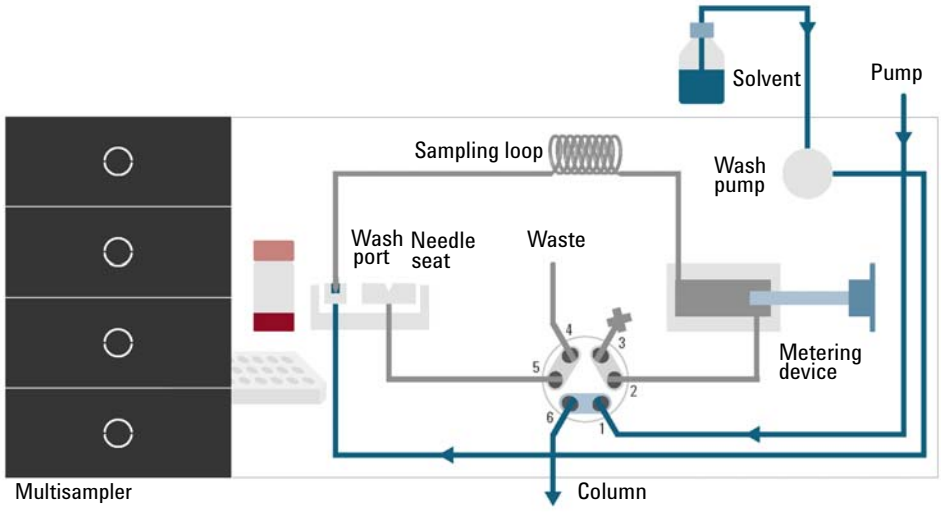

Figure 5 Valve in bypass, washing needle

Inject-and-Run

The final step is the inject- and run-step. The six-port valve is switched to the mainpass position, and directs the flow back through the sample loop, which now contains a certain amount of sample. The solvent flow transports the sample onto the column, and separation begins. This is the beginning of a run within an analysis. In this stage, all major performance-influencing hardware is flushed internally by the solvent flow. For standard applications no additional flushing procedure is required.

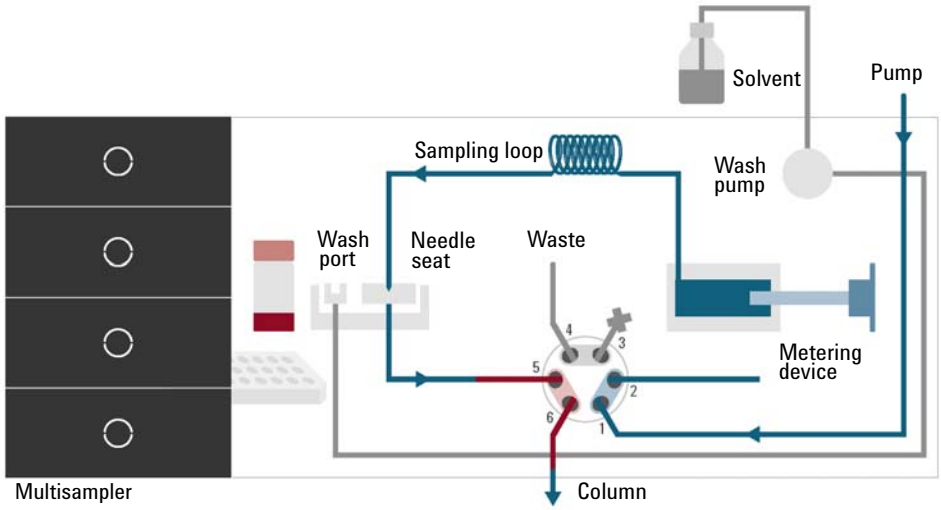

Figure 6 Valve in mainpass, sample injected

Needle seat back flush

After the injection to reduce the carry- over for very sensitive analysis, the needle seat can be flushed by an integrated flush pump with up to 3 different solvents which may have different properties and solvent strengths. As soon as injection valve is in bypass mode the flush pump delivers some solvent during a defined time to clean the needle seat. The back flushing solvent will be guided into the waste line attached on the needle wash port. At the end of this process the injection valve switches back into the mainpass position ready for the next injection. The last rinsing step should always include the mobile phase as solvent to get the initial conditions again.

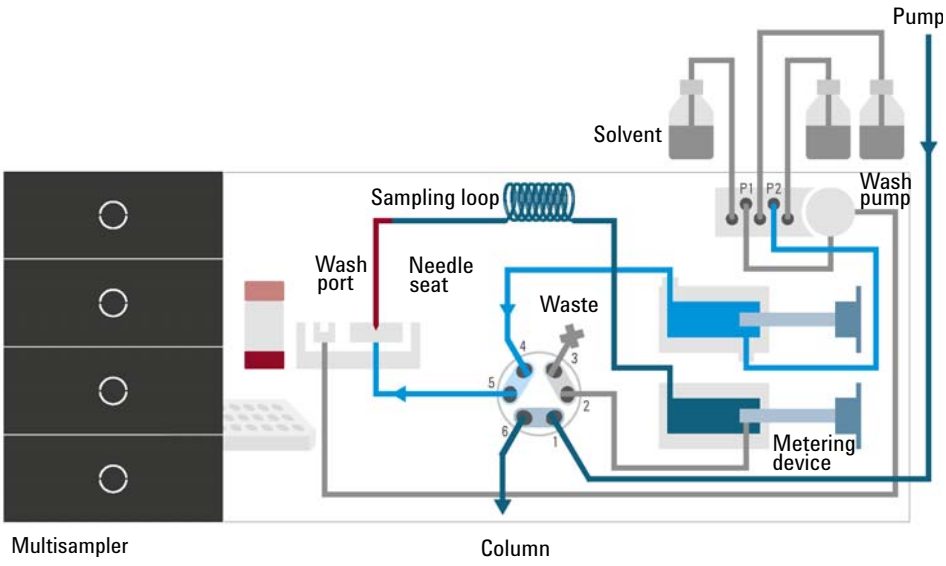

Figure 7 Valve in bypass, needle backflush (Multiwash)

Injection Sequence for dual needle (alternating mode)

Flushing the system

The Start of the pump or changes in solvent composition trigger the purge routine of the multisampler. The purge routine flushes the hydraulic setup of the multisampler with fresh mobile phase (for example metering device, sample loops, and needles). This ensures cleanness of the flowpath.

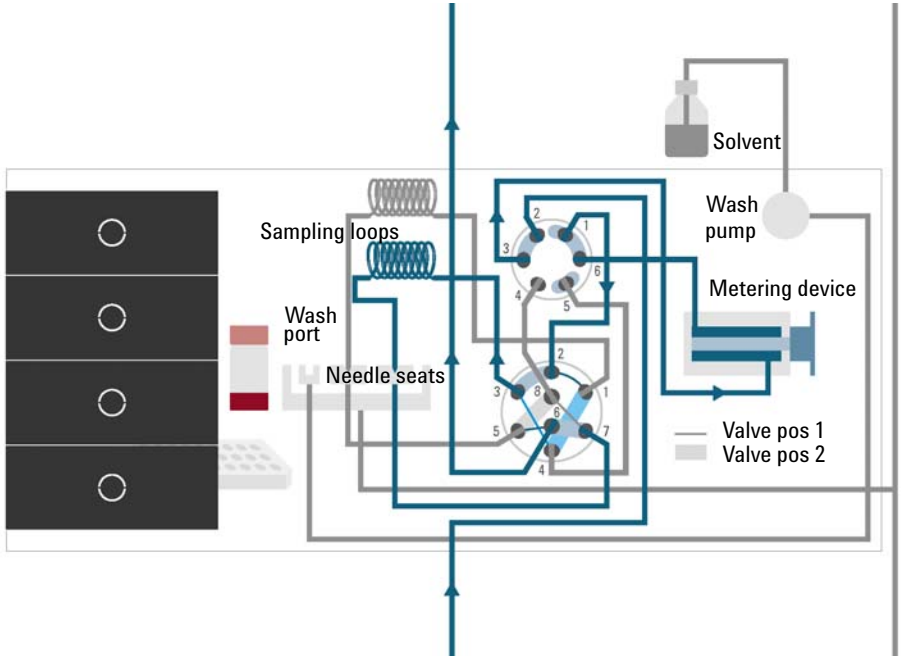

Figure 8 Valve in mainpass (right), metering device purged, and alternate dual needle injection prepared

NOTE For pumps with a manual purge valve, it is mandatory to start the purge routine before a run or sequence. This will guarantee that the complete flow path of the dual needle setup is flushed with fresh mobile phase.

The robot moves the wellplates or vial trays from the sample hotel to the central workspace. The injection valve unit switches to the mainpass (left) position. Then the sampling process starts. Solvent from the pump enters the peripheral valve at port 2, and flows through port 1 directly to the injection valve. The solvent enters the injection valve at port 2, flows via port 1 through the sample loop (left), the needle (left), the needle seat (left), port 5 and port 6 to the column.

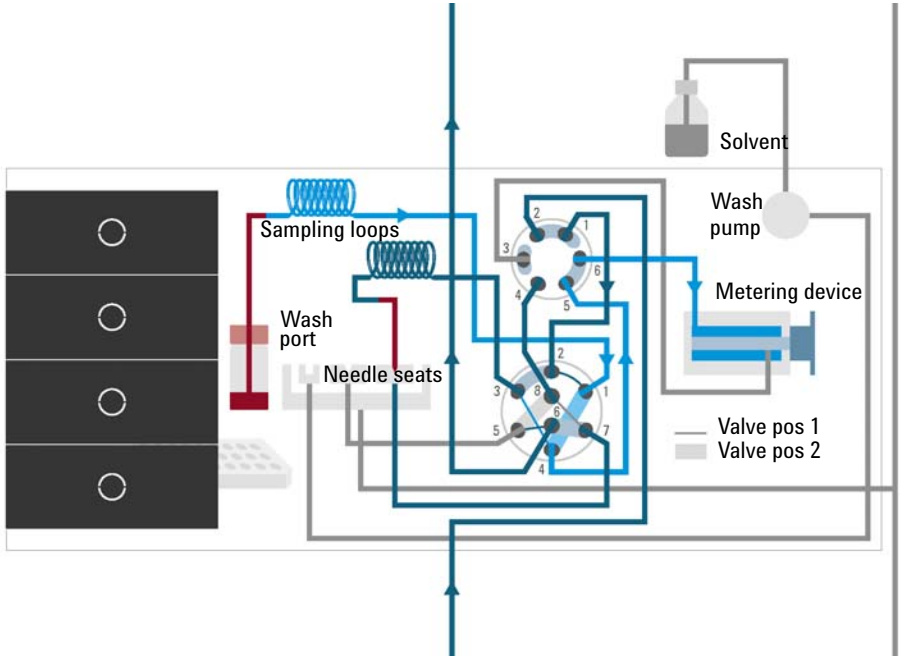

Figure 9 Valve in mainpass (right), drawing sample with left needle

Drawing sample (right)

Then the needle assembly (right) moves to the desired sample position and immerses into the sample. The plunger of the metering device moves back and draws up the desired volume. Then the needle assembly (right) raises and moves to the needle park station on the needle seat (right). This closes the sample loop (right).

Flush the Needle (if selected)

To reduce carry-over, the outside of the left or the right needle can be washed in the flush port that is located behind the needle park station. As soon as the needle is on the flush port, a wash pump flushes the outside of the needle for a defined time (defined for example in the method). After this process the needle assembly returns to the appropriate needle park station. This closes the sample loop (right).

Alternating Dual needle Inject and Run (Right needle)

The eight port valve switches to the mainpass (right) position. Now Port 2 and 3 and Port 7 and 6 of the injection valve are connected. This directs the flow through the sample loop (right) and the solvent transports the sample to the column. Separation and analysis starts. In the meantime, the flow path (right) is flushed internally by the solvent.

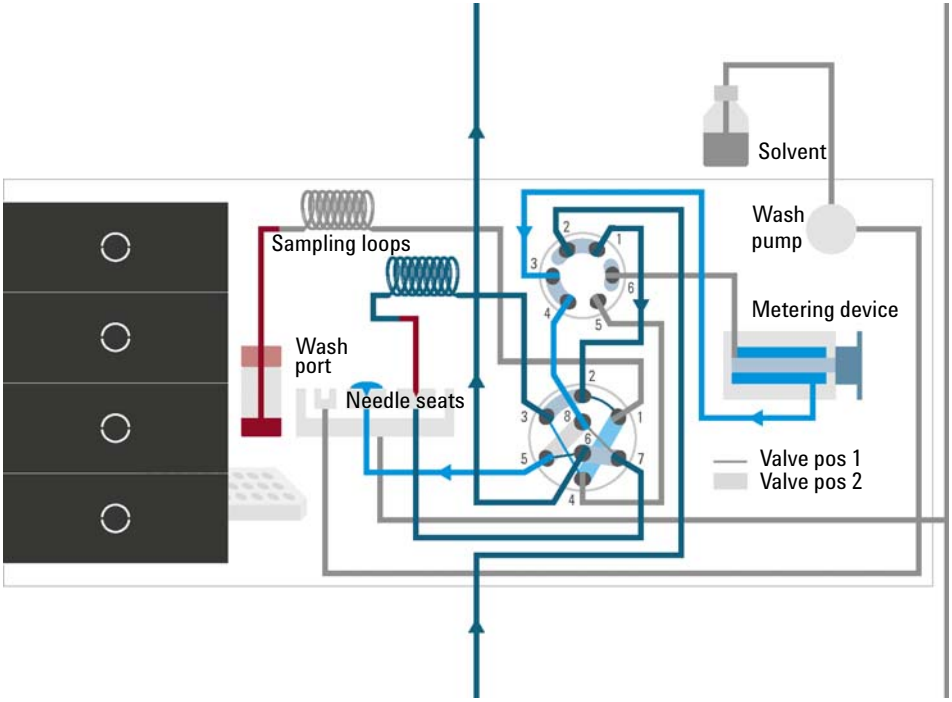

Figure 10 Valve in mainpass (right), metering home (multi-load position of the peripheral valve)

Prepare Inject and Run of the alternating dual needle (left needle)

The sample container is in the central sample work space. The robot detaches the needle assembly (left) from the needle port. The metering device drives to the home position. Then the needle assembly (left) is moved to the desired sample position and immerses into the sample. The plunger of the metering device moves back and draws up the desired volume. Then the needle assembly (left) raises and moves to the needle park station on the needle seat (left). This closes the sample loop (left).

The left needle can be flushed as the right needle, see description above.

The eight port valve switches to the mainpass (left) position. Now Port 2 and 1 and Port 5 and 6 of the injection valve are connected. This directs the flow through the sample loop (left) and the solvent transports the sample to the column. Separation and analysis starts. In the meantime, the flow path (left) is flushed internally by the solvent.

The alternating flush and injection cycles minimize injection cycle times and ensure maximal cleanness of the hardware.

Multi-load with Dual needle (left needle)

In the multi-load mode, the peripheral valve switches in different positions while the plunger of the metering device moves back and forward. At the same time, the needle remains in the sample vial or well. That way the multi-load technique allows to draw and inject large sample volumes. This multi-load technique is completely different from the multi-draw technique that is used in other autosamplers.

System Overview

Leak and Waste Handling

The 1290 Infinity II Series has been designed for safe leak and waste handling. It is important that all security concepts are understood and instructions are carefully followed.

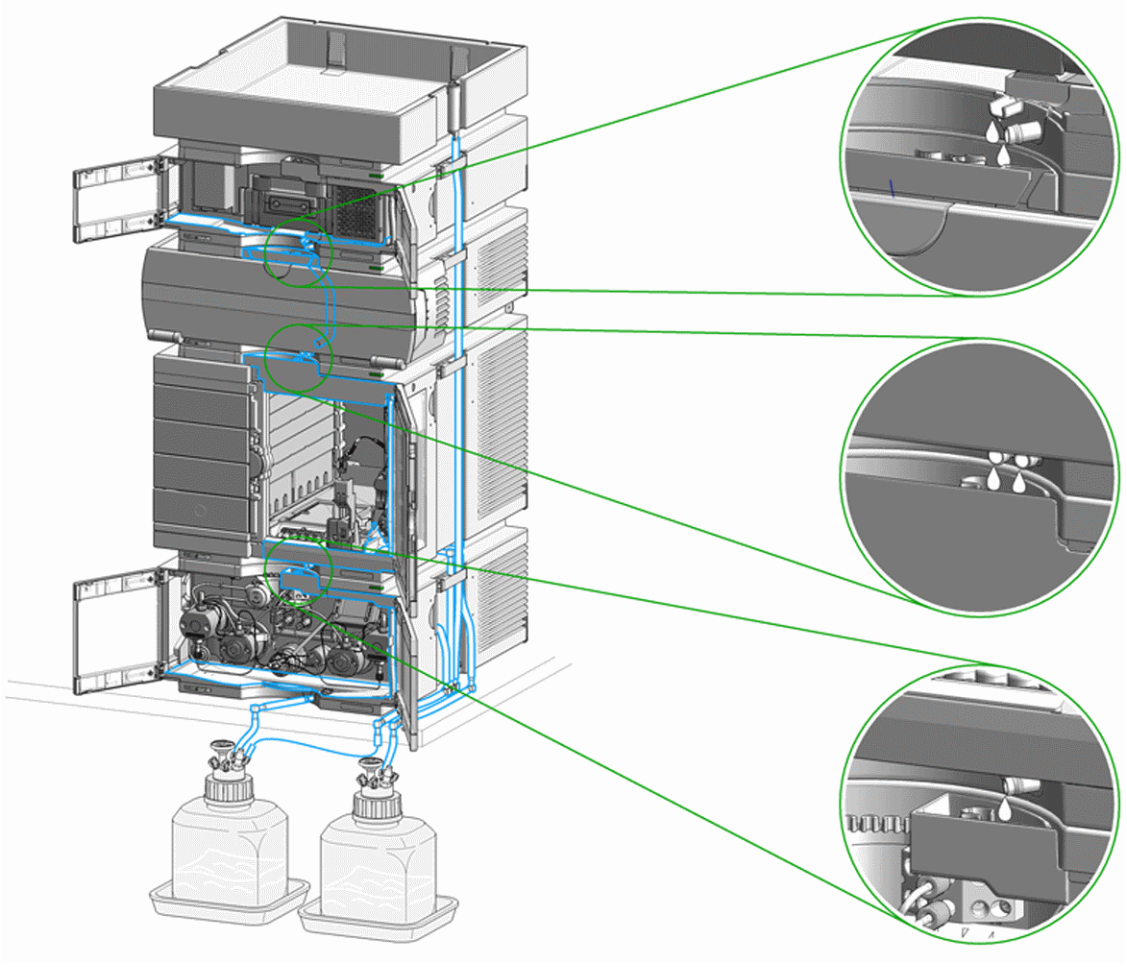

Figure 11 Leak and waste handling concept (overview - typical stack configuration as an example)

The solvent cabinet is designed to store a maximum volume of 8 L solvent. The maximum volume for an individual bottle stored in the solvent cabinet should not exceed 2 L. For details, see the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets (a printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet).

All leak plane outlets are situated in a consistent position so that all Infinity and Infinity II modules can be stacked on top of each other. Waste tubes are guided through a channel on the right hand side of the instrument, keeping the front access clear from tubes.

The leak plane provides leak management by catching all internal liquid leaks, guiding them to the leak sensor for leak detection, and passing them on to the next module below, if the leak sensor fails. The leak sensor in the leak plane stops the running system as soon as the leak detection level is reached.

Solvent and condensate is guided through the waste channel into the waste container:

- from the detector's flow cell outlet
- from the Multisampler needle wash port
- from the Sample Cooler (condensate)
- from the Seal Wash Sensor
- from the pump's Purge Valve or Multipurpose Valve

The waste tube connected to the leak pan outlet on each of the bottom instruments guides the solvent to a suitable waste container.

NOTE Do not install the waste tubings into the central waste connectors.

Waste Guidance

NOTE The waste drainage must go straight into the waste containers. The waste flow must not be restricted at bends or joints.

Waste Concept

1 Agilent recommends using the 6 L waste can with 1 Stay Safe cap GL45 with 4 ports (5043-1221) for optimal and safe waste disposal. If you decide to use your own waste solution, make sure that the tubes don't immerse in the liquid.

Leak and Waste Handling in a Mixed Configuration

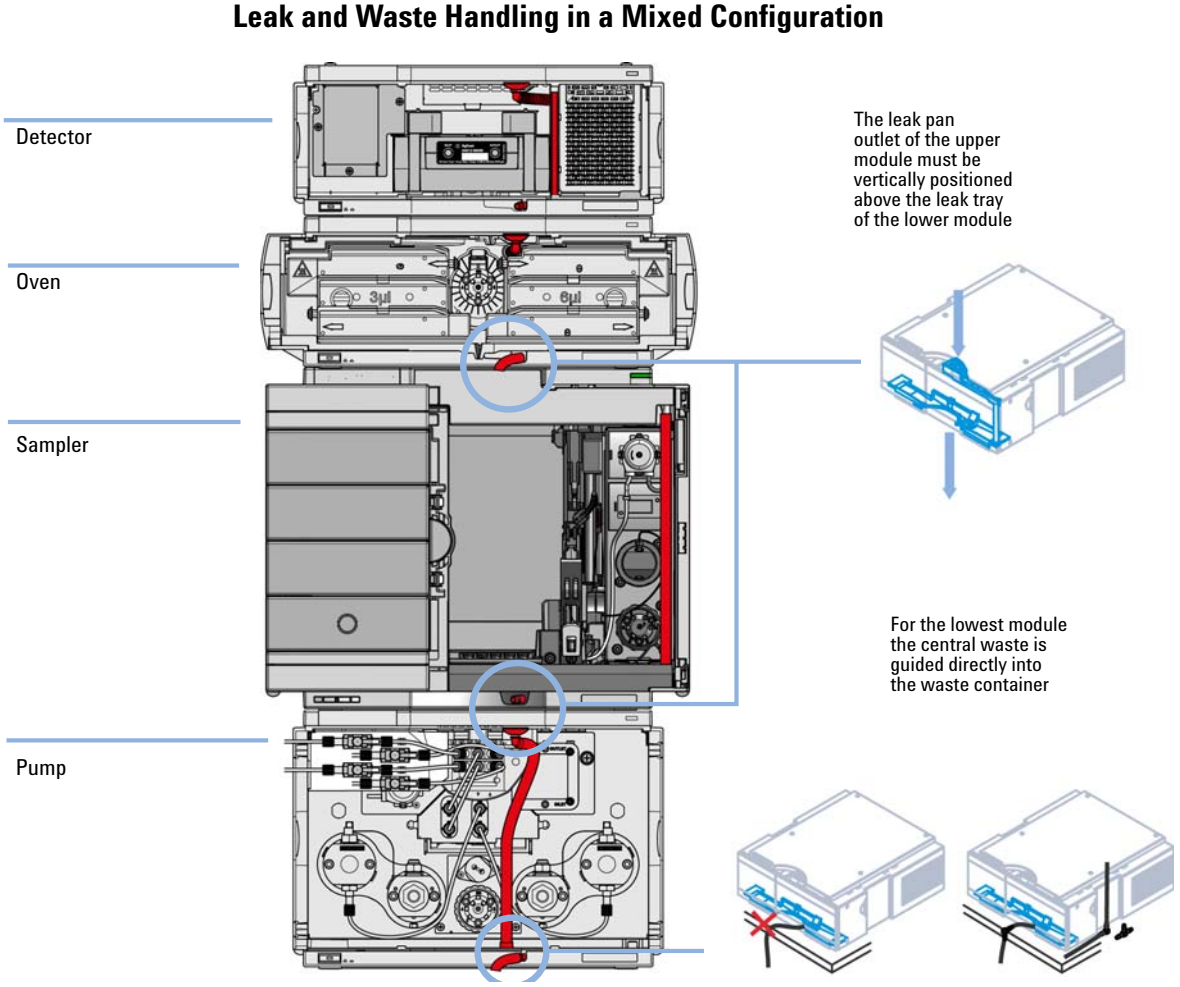

Figure 12 Leak and waste handling with multisampler in a mixed configuration as an example

NOTE Flush solvent from the washport of the multisampler is guided out to the right of the instrument.

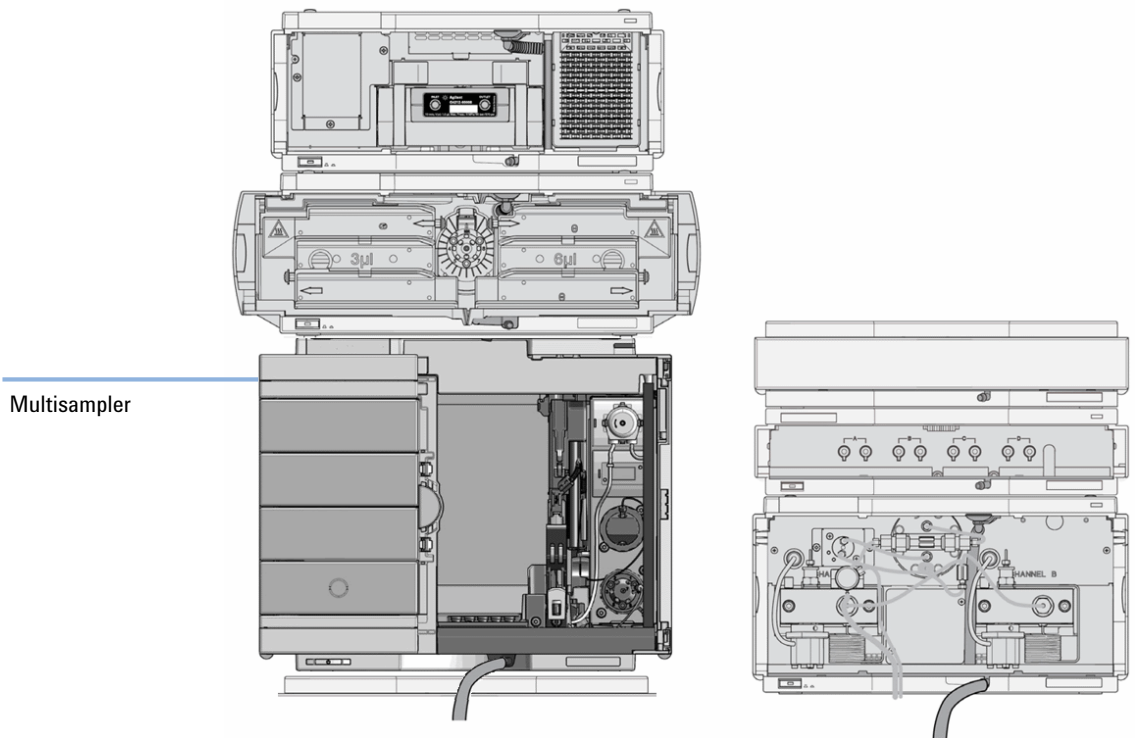

Figure 13 Leak and waste handling with multisampler in a mixed configuration as an example (two stack configuration)

NOTE Do not place the multisampler directly on the bench if a sample cooler is installed.

2
Site Requirements and Specifications

Site Requirements 34
Physical Specifications 37
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Physical Specifications of the Sample Cooler 44

This chapter provides information on environmental requirements, physical and performance specifications.

Site Requirements

A suitable environment is important to ensure optimal performance of the instrument.

Power Considerations

The module power supply has wide ranging capability. It accepts any line voltage in the range described in Table 1 on page 37. Consequently there is no voltage selector in the rear of the module. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING

Hazard of electrical shock or damage of your instrumentation

can result, if the devices are connected to a line voltage higher than specified.

➔ Connect your instrument to the specified line voltage only.

WARNING

The module is partially energized when switched off, as long as the power cord is plugged in.

Repair work at the module can lead to personal injuries, e.g. electrical shock, when the cover is opened and the module is connected to power.

➔ Always unplug the power cable before opening the cover.

➔ Do not connect the power cable to the instrument while the covers are removed.

WARNING

Inaccessible power plug.

In case of emergency it must be possible to disconnect the instrument from the power line at any time.

➔ Make sure the power connector of the instrument can be easily reached and unplugged.

➔ Provide sufficient space behind the power socket of the instrument to unplug the cable.

Power Cords

Country-specific power cords are available for the module. The female end of all power cords is identical. It plugs into the power-input socket at the rear. The male end of each power cord is different and designed to match the wall socket of a particular country or region.

Agilent makes sure that your instrument is shipped with the power cord that is suitable for your particular country or region.

WARNING

Absence of ground connection

The absence of ground connection can lead to electric shock or short circuit.

➔ Never operate your instrumentation from a power outlet that has no ground connection.

WARNING

Unintended use of supplied power cords

Using power cords for unintended purposes can lead to personal injury or damage of electronic equipment.

➔ Never use a power cord other than the one that Agilent shipped with this instrument.

➔ Never use the power cords that Agilent Technologies supplies with this instrument for any other equipment.

➔ Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

WARNING

Power cords

Solvents may damage electrical cables.

➔ Prevent electrical cables from getting in contact with solvents.

➔ Exchange electrical cables after contact with solvents.

Bench Space

The module dimensions and weight (see Table 1 on page 37) allow you to place the module on almost any desk or laboratory bench. It needs an additional 2.5 cm (1.0 inches) of space on either side and approximately 8 cm (3.1 inches) in the rear for air circulation and electric connections.

If the bench shall carry a complete HPLC system, make sure that the bench is designed to bear the weight of all modules.

The module should be operated in a horizontal position, especially if a sample cooler is installed. Check position with a bulb.

NOTE Agilent recommends that you install the HPLC instrument in the A-Line Flex Bench rack. This option helps to save bench space as all modules can be placed into one single stack. It also allows to easily relocate the instrument to another Lab.

WARNING **Heavy weight**

The module is heavy (>22 kg (>46 lbs)).

- ➔ Carry the module at least with 2 people.
- ➔ Avoid back strain or injury by following all precautions for lifting heavy objects.
- ➔ Ensure that the load is as close to your body as possible.
- ➔ Ensure that you can cope with the weight of your load.

Condensation

CAUTION Condensation within the module

Condensation can damage the system electronics.

- ➔ Do not store, ship or use your module under conditions where temperature fluctuations could cause condensation within the module.
- ➔ If your module was shipped in cold weather, leave it in its box and allow it to warm slowly to room temperature to avoid condensation.

Physical Specifications

Table 1 Physical Specifications

Type	Specification	Comments
Weight	22 kg (48.5 lbs)	w/o sample cooler
Dimensions (height × width × depth)	320 x 396 x 468 mm (12.6 x 15.6 x 18.4 inches)	
Line voltage	100 – 240 V~, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Power consumption	180 VA, 180 W	
Ambient operating temperature	4 - 40 °C (39 - 104 °F)	
Ambient non-operating temperature	-40 – 70 °C (-40 – 158 °F)	
Humidity	< 95 % r.h. at 40 °C (104 °F)	Non-condensing
Operating altitude	Up to 3000 m (9842 ft)	
Non-operating altitude	Up to 4600 m (15092 ft)	For storing the module
Safety standards: IEC, EN, CSA, UL	Installation category II, Pollution degree 2	For indoor use only.
ISM Classification	ISM Group 1 Class B	According to CISPR 11

Performance Specifications

Performance Specifications (G7167B)

Table 2 Agilent 1290 Infinity II Multisampler (G7167B) Performance Specifications

Type	Specification	Comment
Injection range for *Single-needle* instruments	Default: 0.1 – 20 µL in 0.1 µL increments; optional: 40 µL or 100 µL (using 100 µL analytical head)	Up to 1300 bar using 40 µL (default) or optional 100 µL analytical head
	0.1 – 500 µL or 900 µL in 0.1 µL increments (using 900 µL analytical head)	Pressure range up to 400 bar due to 900 µL analytical head
	0.1 – 120 µL in 0.1 µL increments with 1290 Infinity large volume injection kit (hardware modification required) G4216-68711 0.1 – 500 µL or 1500 µL in 0.1 µL increments with 100 µL upgrade kit (hardware modification required) G7167-68711	Pressure range up to 1300 bar Multi-draw modus (Injection into needle-seat capillary)
Injection range for *Dual-needle* instruments	Default: 0.1 – 20 µL in 0.1 µL increments; optional: 40 µL or 100 µL	Up to 1300 bar using 100 µL analytical head
	Up to 500 µL in 0.1 µL increments depending on installed loop size	Up to 1300 bar using 100 µL analytical head + Multi-load
Precision for *Single-needle* instruments	<0.15 % RSD or SD <10 nL, whatever is greater	Measured caffeine
Precision for *Dual-needle* instruments	<0.2 % RSD or SD <10 nL, whatever is greater	Measured caffeine
Pressure range	Up to 1300 bar (G7167B)	Max pressure for basic instrument
Sample viscosity range	0.2 – 5 cp	

Table 2 Agilent 1290 Infinity II Multisampler (G7167B) Performance Specifications

Type	Specification	Comment
Sample capacity	1H Drawer up to 8 drawers and 16 positions Shallow well plates (MTP)	Max. 6144/1536 samples (384MTP/96)
	2H Drawer up to 4 drawers and 8 positions MTP, deep well plates, vials, Eppendorf	3072 samples, 432 vials (2 mL)
	3H Drawer up to 2 drawers and 4 positions MTP, deep well plates, vials up to 6 mL, Eppendorf	1536 samples, 60 vials (6 mL), 384 vials (1 mL), 216 vials (2 mL)
Injection cycle time	<10 s using following standard conditions: Default draw speed: 100 µL/min	Using standard Single-needle setup
	Default eject speed: 400 µL/min Injection volume: 1 µL	Time between 2 injections is not mechanically limited, time delay depends on communication speed of software, OS or network connections

Carry Over	<0.003 % (30 ppm) Multisampler Standard and Dual Needle
	<0.0009 % (9 ppm) Multisampler Multiwash
		Using the following conditions:
		• Column: Agilent Pursuit XRs 3 C18, 2.0 x 50 mm
		• Mobile phase:
		  ◦ A: 0.1 % TFA in water
		  ◦ B: 0.1 % TFA in Acetonitrile
		• Isocratic : % B=40 %
		• Flow rate: 0.5 mL/min
		• Temperature: 25 °C
		• Wavelength: 257 nm
		• Sample: 1200 ng/µL Chlorhexidine (dissolved with mobile phase A), 1 µL injected and measured on G4212A DAD
		• Wash solution: H_2O with 0.1 % TFA (3 s)

Multiwash	Outer needle wash and seat backflush for carryover reduction with up to 3 different solvents	

Table 2 Agilent 1290 Infinity II Multisampler (G7167B) Performance Specifications

Type	Specification	Comment
Control and data evaluation	Agilent Open Lab CDS	A.02.01 or above (A.02.02 supports Sample Entry UI)
	MassHunter QQQ	B.07.00 SP1[1] or above
	MassHunter QTOF	B.05.01 SP3[1] or above
	Lab Advisor	B.02.05 or above
	ICF for 3rd party SW control	A.02.01 or above
	LC and CE Drivers	A.02.10 or above
Local Control	Agilent Instant Pilot (G4208A)	B.02.17 or above (currently not supported/official release 2015)
Communications	Controller-area network (CAN), Local Area Network (LAN) ERI: ready, start, stop and shut-down signals	
Safety and maintenance	Extensive support for troubleshooting and maintenance is provided by the Instant Pilot, Agilent Lab Advisor, and the Chromatography Data System. Safety-related features are leak detection, safe leak handling, leak output signal for shutdown of pumping system, and low voltages in major maintenance areas.	
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage with user-settable limits and feedback messages. Electronic records of maintenance and errors.	
Housing	All materials recyclable.	
Metering device	Metering device in high pressure flow path	

[1] only for the integration in an Infinity I LC setup

Performance Specifications (G7167A)

Table 3 Agilent 1260 Infinity Multisampler (G7167A) Performance Specifications

Type	Specification	Comment
Injection range for *Single-needle* instruments	Default: 0.1 – 100 µL in 0.1 µL increments; optional: 20 µL or 40 µL (using optional 40 µL analytical head)	Up to 600 bar using 100 µL (default) or optional 40 µL analytical head
	0.1 – 500 µL or 900 µL in 0.1 µL increments (using 900 µL analytical head)	Pressure range up to 400 bar due to 900 µL analytical head
	0.1 – 120 µL in 0.1 µL increments with 1290 Infinity large volume injection kit (hardware modification required) G4216-68711 0.1 – 500 µL or 1500 µL in 0.1 µL increments with 100 µL upgrade kit (hardware modification required) G7167-68711	Pressure range up to 600 bar Multi-draw modus (Injection into needle-seat capillary)
Injection range for *Dual-needle* instruments	Default: 0.1 – 100 µL in 0.1 µL increments; optional: 20 µL or 40 µL (using 100 µL analytical head)	Up to 600 bar using 100 µL analytical head
	Up to 900 µL in 0.1 µL increments depending on installed loop size	Up to 600 bar using 100 µL analytical head
Precision for *Single-needle* instruments	<0.15 % RSD or SD <10 nL, whatever is greater	Measured caffeine
Precision for *Dual-needle* instruments	<0.2 % RSD or SD <10 nL, whatever is greater	Measured caffeine
Pressure range	Up to 600 bar (G7167A)	Max pressure for basic instrument
Sample viscosity range	0.2 – 5 cp	
Sample capacity	1H Drawer up to 8 drawers and 16 positions Shallow well plates (MTP)	Max. 6144/1536 samples (384MTP/96)
	2H Drawer up to 4 drawers and 8 positions MTP, deep well plates, vials, Eppendorf	3072 samples, 432 vials (2 mL)
	3H Drawer up to 2 drawers and 4 positions MTP, deep well plates, vials up to 6 mL, Eppendorf	1536 samples, 60 vials (6 mL), 384 vials (1 mL), 216 vials (2 mL)

Table 3 Agilent 1260 Infinity Multisampler (G7167A) Performance Specifications

Type	Specification	Comment
Injection cycle time	<10 s using following standard conditions: Default draw speed: 100 µL/min	Using standard Single-needle setup
	Default eject speed: 400 µL/min Injection volume: 1 µL	Time between 2 injections is not mechanically limited, time delay depends on communication speed of software, OS or network connections

Carry Over	<0.003 % (30 ppm) Multisampler Standard and Dual Needle
	<0.0009 % (9 ppm) Multisampler Multiwash
		Using the following conditions:
		• Column: Agilent Pursuit XRs 3 C18, 2.0 x 50 mm
		• Mobile phase:
		  ◦ A: 0.1 % TFA in water
		  ◦ B: 0.1 % TFA in Acetonitrile
		• Isocratic : % B=40 %
		• Flow rate: 0.5 mL/min
		• Temperature: 25 °C
		• Wavelength: 257 nm
		• Sample: 1200 ng/µL Chlorhexidine (dissolved with mobile phase A), 1 µL injected and measured on G4212A DAD
		• Wash solution: H_2O with 0.1 % TFA (3 s)

Multiwash	Outer needle wash and seat backflush for carryover reduction with up to 3 different solvents	
Control and data evaluation	Agilent Open Lab CDS	A.02.01 or above (A.02.02 supports Sample Entry UI)
	MassHunter QQQ	B.07.00 SP1[1] or above
	MassHunter QTOF	B.05.01 SP3[1] or above
	Lab Advisor	B.02.05 or above
	ICF for 3rd party SW control	A.02.01 or above
	LC and CE Drivers	A.02.10 or above
Local Control	Agilent Instant Pilot (G4208A)	B.02.17 or above (currently not supported/official release 2015)

Table 3 Agilent 1260 Infinity Multisampler (G7167A) Performance Specifications

Type	Specification	Comment
Communications	Controller-area network (CAN), Local Area Network (LAN) ERI: ready, start, stop and shut-down signals	
Safety and maintenance	Extensive support for troubleshooting and maintenance is provided by the Instant Pilot, Agilent Lab Advisor, and the Chromatography Data System. Safety-related features are leak detection, safe leak handling, leak output signal for shutdown of pumping system, and low voltages in major maintenance areas.	
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage with user-settable limits and feedback messages. Electronic records of maintenance and errors.	
Housing	All materials recyclable.	
Metering device	Metering device in high pressure flow path	

[1] only for the integration in an Infinity I LC setup

Physical Specifications of the Sample Cooler

Cooling unit is designed as vapor-compression refrigeration system. Contains fluorinated greenhouse gas (refrigerant) according to the Kyoto protocol. For specifications of refrigerant, charge capacity, carbon dioxide equivalent (CDE), and global warming potential (GWP) see instrument label.

Table 4 Physical Specification of the Sample Cooler

Type	Specification	Comments
Weight	< 6 kg	
Dimensions (height × width × depth)	205 mm x 340 mm x 370 mm	
Refrigerant gas	HFC-134a (0.042 kg)	Ozone depletion potential (ODP) = 0
Line voltage	24 VDC (nominal)	
Current	10 A max.	
Ambient operating temperature	4 – 40 ° C (39.2 – 104 ° F)	
Ambient non-operating temperature	-40 – 70 ° C (-20 – 158 ° F)	
Operating altitude	Up to 3000 m (9842 ft)	
Non-operating altitude	Up to 4600 m (15091 ft)	
Safety standards: IEC, CSA, UL	Installation category II, Pollution degree 2	For indoor use only.

CAUTION

General hazards and improper disposal

Improper disposal of the media and components used pollutes the environment.

- ➔ The breakdown of the sample cooler unit must be carried out by specialist refrigeration company.
- ➔ All media must be disposed of in accordance with national and local regulations.
- ➔ Please contact your local Agilent Service Center in regard to safe environmental disposal of the appliance or check www.agilent.com for more info.

Table 5 Performance Specifications Agilent 1290 Sample Cooler

Type	Specifications
Operating principle	High performance, low-energy consumption micro-compressor based cooler with ozone-friendly HFC-134a coolant (42 g), user-upgradable.
Temperature range	from 4 °C to ambient
Temperature settable	from 4 – 40 °C in 1 ° increments
Temperature accuracy (<25 °C, <50 % r.H.)	2 °C to 6 °C at a setpoint of 4 °C

3
Using the Module

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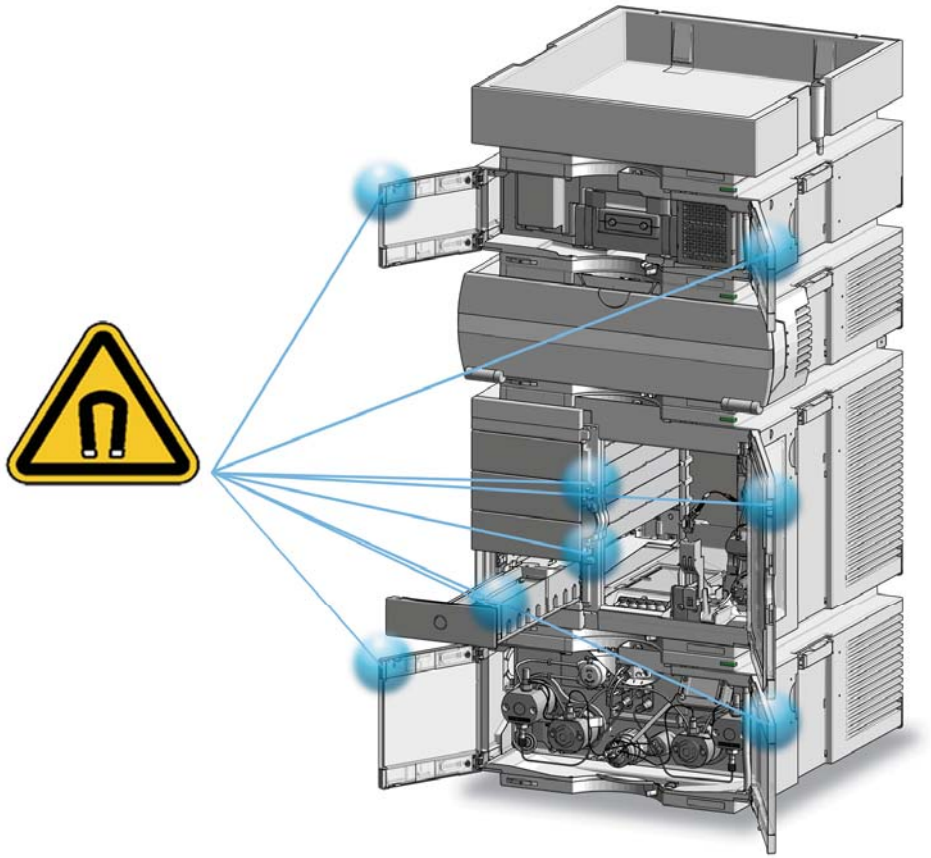
- Install the Sample Cooler 55

Transporting the Multisampler with a Sample Cooler Installed 61

This chapter explains the essential operational parameters of the module.

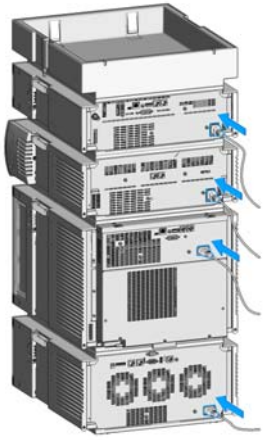
Magnets

1 This stack exemplarily shows the magnets' positions in the modules.

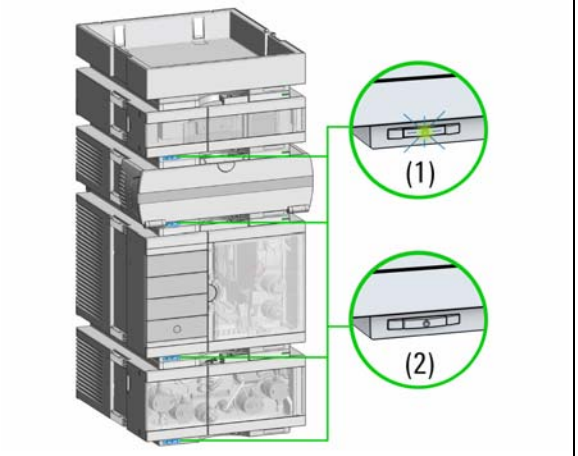


Turn on/off

1



2

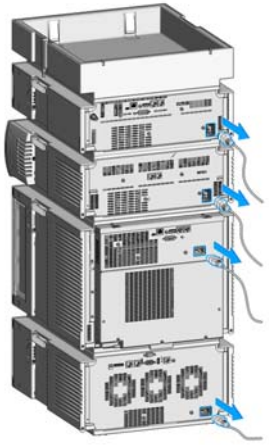


Power switch

(1) On

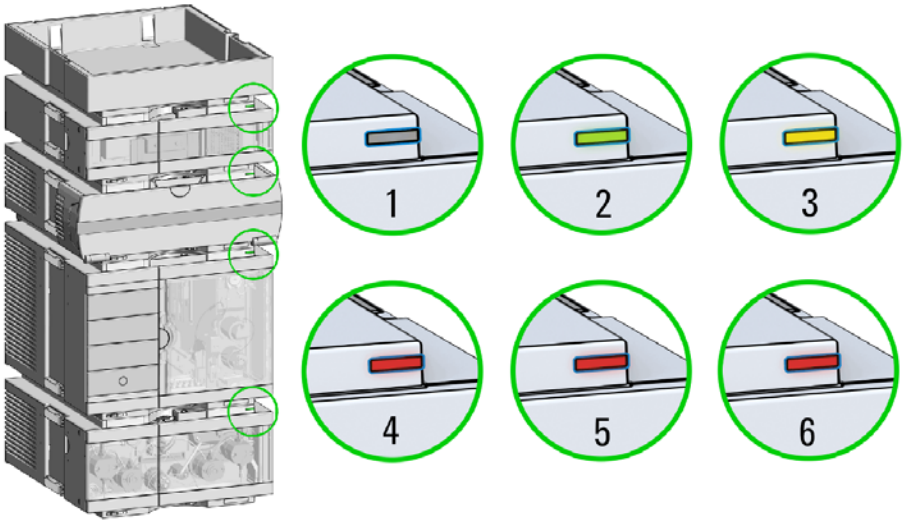
(2) Off

3



Status indicators

1 The module status indicator indicates one of six possible module conditions:



Status indicators

1. Idle

2. Run mode

3. Not-ready. Waiting for a specific pre-run condition to be reached or completed.

4. Error mode - interrupts the analysis and requires attention (for example a leak or defective internal components).

5. Resident mode (blinking) - for example during update of main firmware.

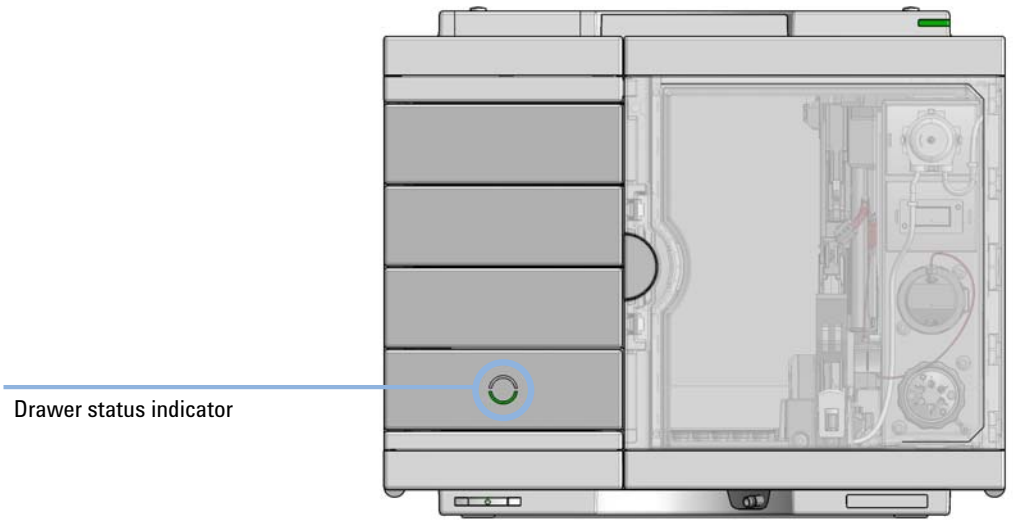
6. Bootloader mode (fast blinking). Try to re-boot the module or try a cold-start. Then try a firmware update.

Drawer Status Indicator

The module status indicator indicates one of three possible module conditions:

- When the status indicator is *OFF* no sample containers are loaded.
- When the upper, lower or both semi circle status indicators are *ON*, indicates the rear or front position of the drawer or both positions are loaded with a sample containers.
- When semi circle indicators are *blinking* the robot interacts with a drawer.

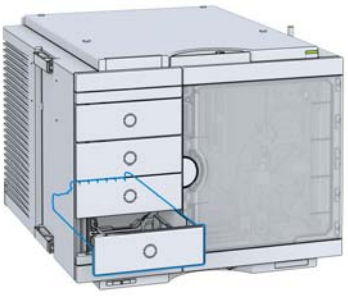
NOTE During blinking of the drawer status indicator. Do not try to open the drawer at this point.



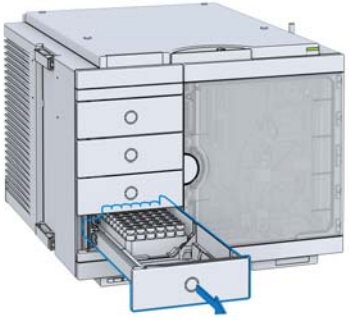
Insert vial trays/wellplates

1

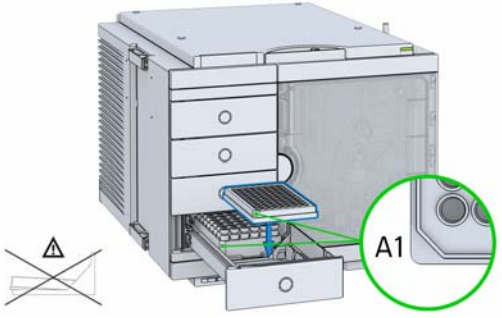
2



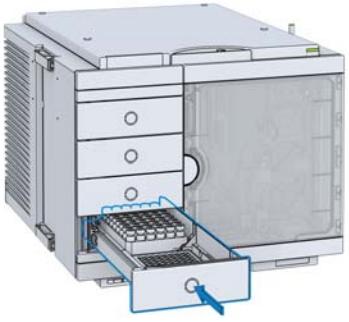
3



4 Ensure correct seat and orientation of vial trays/wellplates



5



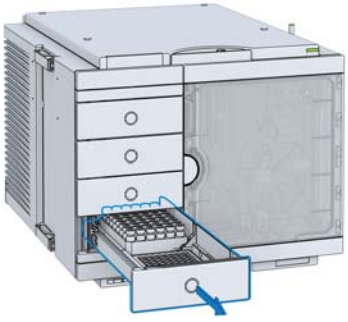
6

Remove vial trays/wellplates

1

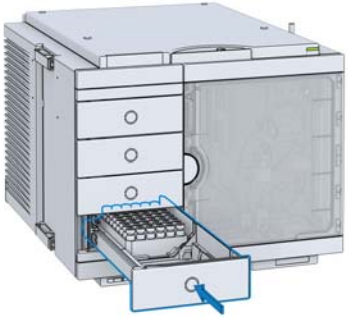
2

3



4

5



6

Installing the Sample Cooler

Damaged Packaging

If the delivery packaging shows signs of external damage, please call your Agilent Technologies sales and service office immediately. Inform your service representative that the instrument may have been damaged during shipment.

CAUTION

"Defective on arrival" problems

If there are signs of damage, please do not attempt to install the module. Inspection by Agilent is required to evaluate if the instrument is in good condition or damaged.

➔ Notify your Agilent sales and service office about the damage.

➔ An Agilent service representative will inspect the instrument at your site and initiate appropriate actions.

Install the Sample Cooler

Parts required	p/n	Description
		Multisampler
	G7167-60005	Sample cooler
		Power cord

Hardware required Other cables see below and "Cable Overview" on page 240

Software required OpenLabCDS and/or Instant Pilot G4208A with the appropriate revisions, see Table 2 on page 38.

NOTE If the sample cooler is disconnected from the power supply, you should wait for at least five minutes before replugging and switching on the compressor again.

NOTE Even under average humidity conditions, a significant amount of condensed water gathers every day. A suitable container must be provided and emptied regularly in order to avoid overflow.

NOTE For best cooling performance the 2H drawer must be installed in the lowest position.

CAUTION Condensate inside the sample cooler

Damage to the electronics of the module

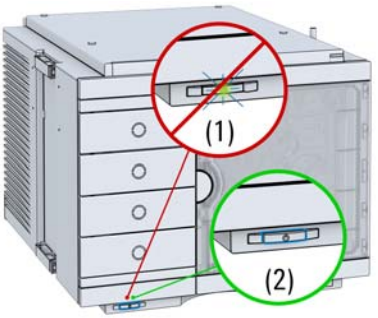
➔ Before dismounting the sample cooler:

➔ Make sure the power cords are disconnected

➔ Make sure there is no condensate inside the module

1 Place the sampler on the bench.

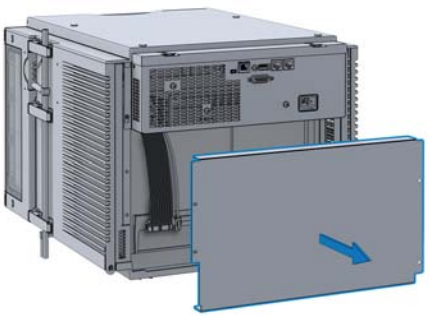
2 Ensure that the power switch on the front of the module is OFF (switch stands out).



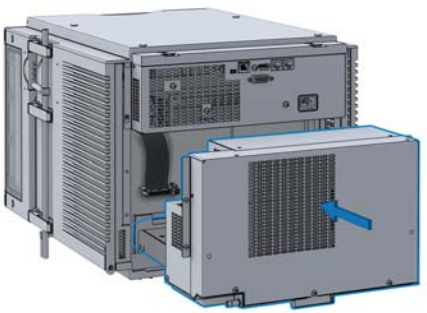
3 Ensure that the power cable is removed from the instrument.

4 Open the 4 screws on the rear of the module.

5 Remove the sample cooler mainframe cover.



6 Slide in the sample cooler the halfway.



WARNING

Module is partially energized when switched off, as long as the power cord is plugged in.
Repair work at the module can lead to personal injuries, e.g. shock hazard, when the cover is opened and the module is connected to power.

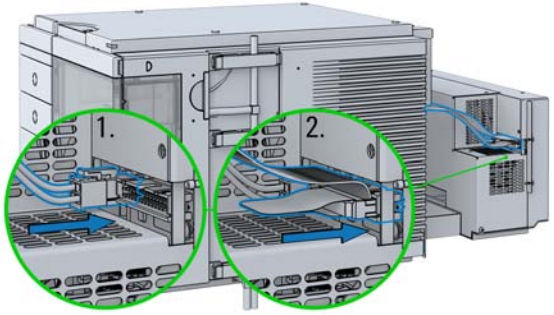
- **Make sure that it is always possible to access the power plug.**
- **Do not use the sample cooler if it is not operating correctly or has been damaged. Disconnect it from the power supply and call your local service center.**
- **Remove the power cable from the module before opening the cover.**
- **Do not connect the power cable to the module while the covers are removed.**
- **If the sample cooler is disconnected from the power supply, you should wait for at least five minutes before switching on the compressor.**

CAUTION

Damaged electronics

- **To avoid damages of the electronics of the module make sure the power cords are unplugged before disconnecting or reconnecting the sampler to the sample cooler cables.**

7 Connect power cable and signal/data cable.

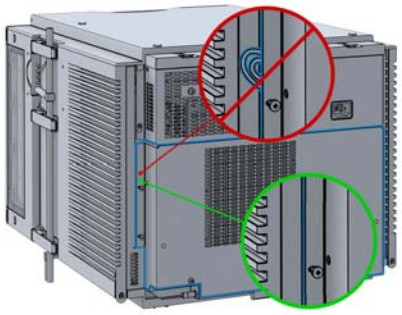


CAUTION

Damage to the cables

- **Do not bend or pinch the cables.**
- **Fit in the sample cooler perfectly.**

8 Slide in the whole unit.



9 Tighten the 4 screws which holds the sample cooler unit in place.

WARNING

Heavy weight
The module is heavy (>22 kg (>46 lbs)).

- **Carry the module at least with 2 people.**
- **Avoid back strain or injury by following all precautions for lifting heavy objects.**
- **Ensure that the load is as close to your body as possible.**
- **Ensure that you can cope with the weight of your load.**

10 Lift the sampler with the sample cooler installed into the LC stack.

11 Use a bubble level to check the leveling of the sampler.

NOTE

The sample cooler should be operated in a proper horizontal position.

CAUTION

Routing of the condensation tubing
Proper routing of the condensation tubing is critical for correct condensate drainage.

➔ **Do not place the sampler directly on the bench.**

CAUTION

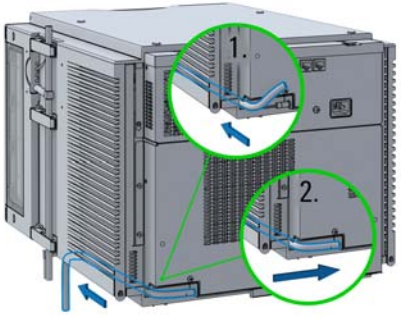
Damage through condensation
If the condensation tube is located in liquid the condensed water cannot flow out of the tube and the outlet is blocked. Any further condensation will then remain in the instrument. This may damage the instruments electronics.

➔ **Make sure the condensation tube is always above the liquid level in the vessel.**

➔ **Make sure the waste container is not sealed.**

➔ **Ensure the drain tube has no loops and leads directly into the waste bottle.**

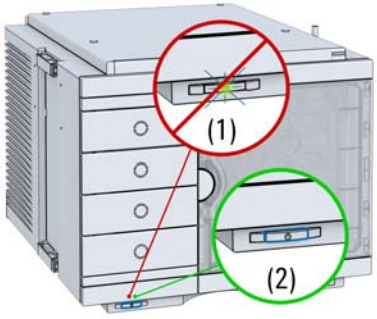
12 Install the condensate tubing on the drain outlet of the sample cooler and guide the condensation tubing out to the central waste.



NOTE

Do not kink the drain tubing and avoid siphoning effects of the drainage.

13 Ensure the power switch on the front of the module is OFF (switch stands out).



14 Connect the CAN interface cables to other modules in the system (see section *Recommended Stack Configurations* in the technical note *Use of Multisampler in Mixed Configurations* or the service manual).

15 If required, connect additional interface and control cables to the autosampler (see section *Recommended Stack Configurations* in the technical note *Use of Multisampler in Mixed Configurations* or the service manual). Refer to the documentation of the Agilent 1200 Infinity Series Instant Pilot or ChemStation for LC for more information.

NOTE

In an Agilent 1290 Infinity or 1260 Infinity system, the individual modules are connected by a CAN cable. The Agilent 1200 Infinity Series Instant Pilot can be connected to the CAN bus at any of the modules in the system. If an Agilent detector is part of the system, usually the LAN connection should be at the detector. For more information about connecting the instant pilot or control software refer to the respective user manual.

For connecting the Agilent 1290 Infinity equipment to non-Agilent 1290 Infinity equipment, see "Cable Overview" on page 240).

CAUTION

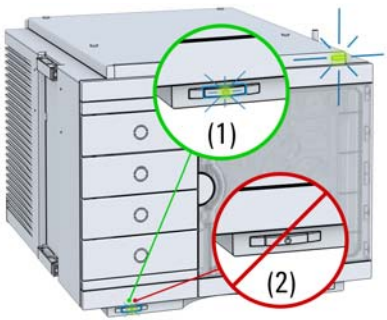
Damage to the sample cooler

➔ **Wait at least 30 min before switching on the compressor of the sample cooler.**

➔ **This allows the refrigerant and system lubrication to reach equilibrium.**

16 Connect the power cable to the power connector at the rear of the module.

17



Power switch

(1) On

(2) Off

Transporting the Multisampler with a Sample Cooler Installed

NOTE There are magnets in the front area of the multisampler, see "Magnets" on page 48.

NOTE When moving the sampler around the laboratory, make sure that any condensed water inside the thermostat is removed.

- Remove the drainage and place a beaker underneath the drain outlet of the sample cooler. Then carefully tilt the module to the back so that the water inside the thermostat can safely flow into the leak funnel. If condensate removal is done improperly, you can harm the electronic of the module.
- Otherwise no special precautions are needed for the modules.

WARNING

Heavy weight

The module is heavy (>22 kg (>46 lbs)).

➔ Carry the module at least with 2 people.

➔ Avoid back strain or injury by following all precautions for lifting heavy objects.

➔ Ensure that the load is as close to your body as possible.

➔ Ensure that you can cope with the weight of your load.

NOTE Transporting the sampler with a sample cooler installed is only allowed for short distances. For longer distances, you must separate the units and send them independently.

CAUTION

Mechanical damage of the module

If the transport assembly is not parked and not protected by the transport foam, the module could be damaged due to excessive shock of the shipping container during transport.

➔ Always park the transport assembly before shipment.

➔ Store the installation foam in a save place, to use it for later transport of the module.

If the sampler with a sample cooler needs to be shipped to another location via carrier, ensure:

- The two modules are shipped in separate boxes.
- The Sample handler of the multisampler is parked, see **Park Robot** in Agilent Lab Advisor online help for more information.
- The sample containers (vial trays) are removed from the sample hotel.
- The condensed water inside of the sample cooler is removed.

4
Preparing the module

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This chapter explains the operational parameters of the module.

Leak and Waste Handling

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

The handling of solvents, samples and reagents can hold health and safety risks.

- ➔ When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.
- ➔ The volume of substances should be reduced to the minimum required for the analysis.
- ➔ Do not operate the instrument in an explosive atmosphere.
- ➔ Never exceed the maximal permissible volume of solvents (6 L) in the solvent cabinet.
- ➔ Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.
- ➔ Arrange the bottles as specified in the usage guideline for the solvent cabinet.
- ➔ A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet.
- ➔ Ground the waste container.
- ➔ The residual free volume in the appropriate waste container must be large enough to collect the waste liquid.
- ➔ Check the filling level of the waste container regularly.
- ➔ To achieve maximal safety, check the correct installation regularly.
- ➔ Do not use solvents with an auto-ignition temperature below 200 °C (392 °F).

NOTE

Recommendations for Solvent Cabinet

For details, see the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.

For correct installation of your system contact your Agilent service representative.

Preparing the Multisampler

For best performance of the multisampler

- When using the multisampler in a system with a vacuum degassing unit, shortly degas your samples before using them in the multisampler.
- Filter samples before use in a 1200 Infinity Series system. Use High pressure filter kit (5067-4638) for inline filtering.
- When using buffer solutions, flush the system with water before switching it off.
- Check the multisampler plungers for scratches, grooves and dents when changing the piston seal. Damaged plungers cause micro leaks and will decrease the lifetime of the seal.
- Solvent Information - Observe recommendations on the use of solvents, see "Solvent Information" on page 66.
- Priming and Purging the System - When the solvents have been exchanged or the system has been turned off for a certain time (for example, overnight) oxygen will re-diffuse into the solvent channel. Therefore priming and purging of the system is required before starting an application.

Table 6 Choice of Priming Solvents for Different Purposes

Activity	Solvent	Comments
After an installation	Isopropanol	Best solvent to flush air out of the system
When switching between reverse phase and normal phase (both times)	Isopropanol	Best solvent to flush air out of the system
After an installation	Ethanol or methanol	Alternative to isopropanol (second choice) if no isopropanol is available
To clean the system when using buffers	Bidistilled water	Best solvent to re-dissolve buffer crystals
After a solvent change	Bidistilled water	Best solvent to re-dissolve buffer crystals

Solvent Information

Observe the following recommendations on the use of solvents.

- Follow recommendations for avoiding the growth of algae, see pump manuals.
- Small particles can permanently block capillaries and valves. Therefore, always filter solvents through 0.4 µm filters.
- Avoid or minimize the use of solvents that may corrode parts in the flow path. Consider specifications for the pH range given for different materials like flow cells, valve materials etc. and recommendations in subsequent sections.

Recommended Wash Solvents

- water
- ethanol
- methanol
- water/acid (especially for basic compounds)
- water/base (especially for acidic compounds)
- water/acetonitrile

Material Information

Materials in the flow path are carefully selected based on Agilent's experiences in developing highest quality instruments for HPLC analysis over several decades. These materials exhibit excellent robustness under typical HPLC conditions. For any special conditions, please consult the material information section or contact Agilent.

Disclaimer

Subsequent data were collected from external resources and are meant as a reference. Agilent cannot guarantee the correctness and completeness of such information. Data is based on compatibility libraries, which are not specific for estimating the long-term life time under specific but highly variable conditions of UHPLC systems, solvents, solvent mixtures and samples. Information can also not be generalized due to catalytic effects of impurities like metal ions, complexing agents, oxygen etc. Apart from pure chemical corrosion, other effects like electro corrosion, electrostatic charging (especially for non-conductive organic solvents), swelling of polymer parts etc. need to be considered. Most data available refers to room temperature (typically 20 – 25 °C, 68 – 77 °F). If corrosion is possible, it usually accelerates at higher temperatures. If in doubt, please consult technical literature on chemical compatibility of materials.

PEEK

PEEK (Polyether-Ether Ketones) combines excellent properties regarding biocompatibility, chemical resistance, mechanical and thermal stability. PEEK is therefore the material of choice for UHPLC and biochemical instrumentation.

It is stable in a pH range between 1 – 12, and inert to many common solvents.

There is still a number of known incompatibilities with chemicals such as chloroform, methylene chloride, THF, DMSO, strong acids (nitric acid > 10 %, sulphuric acid > 10 %, sulfonic acids, trichloroacetic acid), halogenes or aequous halogene solutions, phenol and derivatives (cresols, salicylic acid etc.).

Polyimide

Agilent uses semi-crystalline polyimide for rotor seals in valves and needle seats in autosamplers. One supplier of polyimide is DuPont, which brands polyimide as Vespel, which is also used by Agilent.

Polyimide is stable in a pH range between 1 and 10 and in most organic solvents. It is incompatible with concentrated mineral acids (e.g. sulphuric acid), glacial acetic acid, DMSO and THF. It is also degraded by nucleophilic substances like ammonia (e.g. ammonium salts in basic conditions) or acetates.

Polyethylene (PE)

Agilent uses UHMW (ultra-high molecular weight)-PE/PTFE blends for yellow piston and wash seals, which are used in 1290 Infinity pumps and for normal phase applications in 1260 Infinity pumps.

Polyethylene has a good stability for most common inorganic solvents including acids and bases in a pH range of 1 to 12.5. It is compatible to many organic solvents used in chromatographic systems like methanol, acetonitrile and isopropanol. It has limited stability with aliphatic, aromatic and halogenated hydrocarbons, THF, phenol and derivatives, concentrated acids and bases. For normal phase applications, the maximum pressure should be limited to 200 bar.

Tantalum (Ta)

Tantalum is inert to most common HPLC solvents and almost all acids except fluoric acid and acids with free sulfur trioxide. It can be corroded by strong bases (e.g. hydroxide solutions > 10 %, diethylamine). It is not recommended for the use with fluoric acid and fluorides.

Stainless Steel (ST)

Stainless steel is inert against many common solvents. It is stable in the presence of acids and bases in a pH range of 1 to 12.5. It can be corroded by acids below pH 2.3. It can also corrode in following solvents:

- Solutions of alkali halides, their respective acids (for example, lithium iodide, potassium chloride, and so on) and aqueous solutions of halogens.
- High concentrations of inorganic acids like nitric acid, sulfuric acid and organic solvents especially at higher temperatures (replace, if your chromatography method allows, by phosphoric acid or phosphate buffer which are less corrosive against stainless steel).
- Halogenated solvents or mixtures which form radicals and/or acids, for example:

  $2\ CHCl_3 + O_2 \rightarrow 2\ COCl_2 + 2\ HCl$

  This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol.

- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether). Such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- Solutions of organic acids (acetic acid, formic acid, and so on) in organic solvents. For example, a 1 % solution of acetic acid in methanol will attack steel.
- Solutions containing strong complexing agents (for example, EDTA, ethylene diamine tetra-acetic acid).
- Mixtures of carbon tetrachloride with 2-propanol or THF.

Diamond-Like Carbon (DLC)

Diamond-Like Carbon is inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.

Fused silica and Quartz (SiO_2)

Fused silica is used in 1290 Infinity Flow Cells and capillaries. Quartz is used for classical flow cell windows. It is inert against all common solvents and acids except hydrofluoric acid and acidic solvents containing fluorides. It is corroded by strong bases and should not be used above pH 12 at room temperature. The corrosion of flow cell windows can negatively affect measurement results. For a pH greater than 12, the use of flow cells with sapphire windows is recommended.

Gold

Gold is inert to all common HPLC solvents, acids and bases within the specified pH range. It can be corroded by complexing cyanides and concentrated acids like aqua regia.

Zirconium Oxide (ZrO_2)

Zirconium Oxide is inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.

Platinum/Iridium

Platinum/Iridium is inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.

Fluorinated polymers (PTFE, PFA, FEP, FFKM)

Fluorinated polymers like PTFE (polytetrafluorethylene), PFA (perfluoroalkoxy) and FEP (fluorinated ethylene propylene) are inert to almost all common acids, bases, and solvents. FFKM is perfluorinated rubber, which is also resistant to most chemicals. As an elastomer, it may swell in some organic solvents like halogenated hydrocarbons.

TFE/PDD copolymer tubings, which are used in all Agilent degassers except 1322A, are not compatible with fluorinated solvents like Freon, Fluorinert, or Vertrel. They have limited life time in the presence of Hexafluoroisopropanol (HFIP). To ensure the longest possible life with HFIP, it is best to dedicate a particular chamber to this solvent, not to switch solvents, and not to let dry out the chamber. For optimizing the life of the pressure sensor, do not leave HFIP in the chamber when the unit is off.

Sapphire, Ruby and Al_2O_3-based ceramics

Sapphire, ruby and ceramics based on aluminum oxide Al_2O_3 are inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.

Recommended Mats and Vials

Table 7 Recommended plates and closing mat

Description (Part Number)	Rows	Columns	Plate height	Volume (µL)	Package
384Agilent (5042-1388)	16	24	14.4	80	30
384Corning (No Agilent PN)	16	24	14.4	80	
384Nunc (No Agilent PN)	16	24	14.4	80	
96 well plate 0.5 ml, PP (pack of 10) (5042-1386) 96 well plate 0.5 ml, PP (pack of 120) (5042-1385)	8	12	14.3	500	10 120
96Agilent conical (5042-8502)	8	12	17.3	150	25
96CappedAgilent (5065-4402)	8	12	47.1	300	1
96Corning (No Agilent PN)	8	12	14.3	300	
96CorningV (No Agilent PN)	8	12	14.3	300	
96DeepAgilent31mm (5042-6454)	8	12	31.5	1000	50
96DeepNunc31mm (No Agilent PN)	8	12	31,5	1000	
96DeepRitter41mm (No Agilent PN)	8	12	41.2	800	
96Greiner (No Agilent PN)	8	12	14.3	300	
96GreinerV (No Agilent PN)	8	12	14.3	250	
96Nunc (No Agilent PN)	8	12	14.3	400	
Closing mat for all 96 Agilent plates (5042-1389)	8	12			50

Recommended Vial Plates

p/n	Description
G2255-68700	Vial plate for 54 x 2 mL vials (6/pk)
5022-6539	Vial plate for 15 x 6 mL vials (1/pk)
5022-6538	Vial plate for 27 Eppendorf tubes (1/pk)

NOTE Agilent Technologies recommends to use preslit septa.

NOTE Bottom sensing is a feature to detect the depth of vials or plates via the software.

If the bottom sensing feature is used, the bottom of the plates and vials must resist the needle. Make sure that the material supports this feature.

NOTE For the Needle height position, an offset of 0 equates to 2 mm above the wellplate bottom.

Capillary Color Coding Guide

Type

Key	Description
Capillary	Connection capillaries
Loop	Loop capillaries
Seat	Autosampler needle seats
Tube	Tubing
Heat exchanger	Heat exchanger

Material

Key	Description
ST	Stainless steel
Ti	Titanium
PK	PEEK
FS/PK	PEEK-coated fused silica*
PK/ST	Stainless steel-coated PEEK**
PTFE	PTFE
FS	Fused silica

*Fused silica in contact with solvent
**PEEK in contact with solvent

Fitting Left/Fitting Right

Key	Description
W	Swagelok + 0.8 mm Port id
S	Swagelok + 1.6 mm Port id
M	Metric M4 + 0.8 mm Port id
E	Metric M3 + 1.6 mm Port id
U	Swagelok union
L	Long
X	Extra long
H	Long head
G	Small head SW 4 mm
N	Small head SW 5 mm
F	Fingertight
V	1200 bar
B	Bio
P	PEEK

The **type** gives some indication on the primary function, like a loop or a connection capillary.
The **material** indicates which raw material is used.
The **fitting** left/right indicate which fitting is used on both ends of the capillary.

At-a-glance color-coding keys

The color of your capillary will help you quickly identify the capillary id – see the chart to the right for reference.

Color-coding key for Agilent capillary tubing

Internal Diameter in mm	Color code
0.015	Orange
0.025	Yellow
0.05	Beige
0.075	Black
0.1	Purple
0.12	Red
0.17	Green
0.20/0.25	Blue
0.3	Grey
0.50	Bone White

Tip: As you move to smaller-volume, high efficiency columns, you'll want to use narrow id tubing, as opposed to the wider id tubing used for conventional HPLC instruments.

Figure 14 Syntax for capillary description

Installing Capillaries

For correct installation of capillary connections of the multisampler it's important to choose the correct SL/SX fittings, see “Capillary Color Coding Guide” on page 73.

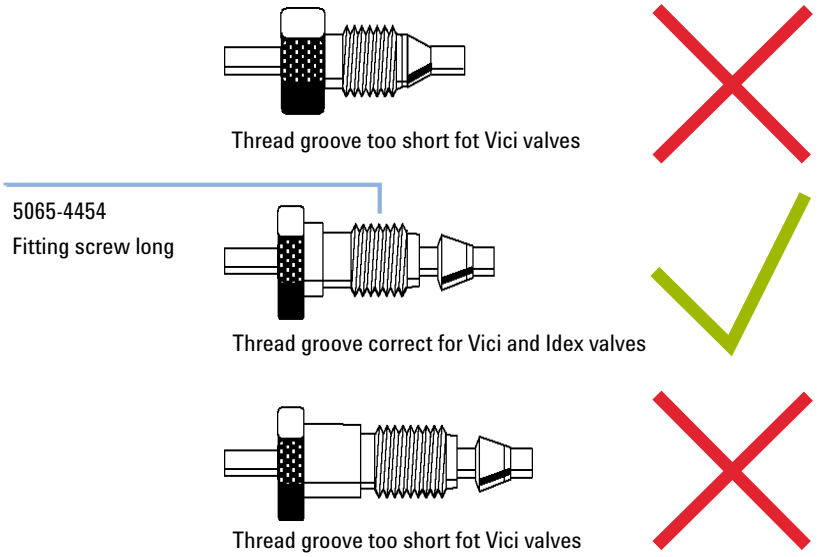


Figure 15 Capillary connections for the multisampler

Note that the SL fittings are backward compatible to the IDEX valves.

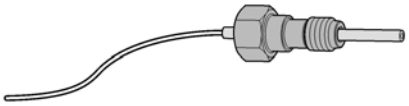
Parts required

p/n	Description
5067-4650	Capillary ST 0.12 mm x 150 mm SL/SX
5067-4651	Capillary ST 0.12 mm x 280 mm SL/SX
5067-4720	Capillary ST 0.17 mm x 150 mm SL/SX
5067-4722	Capillary ST 0.17 mm x 280 mm SL/SX
5065-4454	Fitting screw long 10/pk Quantity depends on configuration of the module (number of connections to the multisampler).

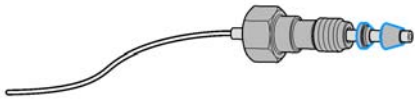
The capillaries mentioned above are examples only.

1 Select a nut that is long enough for the fitting you'll be using.

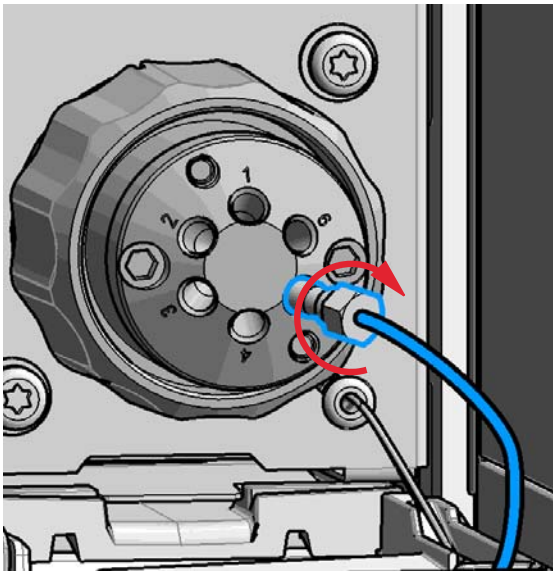
2 Slide the nut over the end of the tubing.



3 Carefully slide the ferrule components on after the nut and then finger-tighten the assembly while ensuring that the tubing is completely seated in the bottom of the end fitting.



4 Use a column or injection valve to gently tighten the fitting which forces the ferrule to seat onto the tubing.

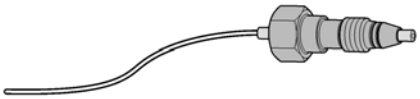


NOTE

Don't overtighten. Overtightening will shorten the lifetime of the fitting.

5 Once you believe you have the fitting complete, loosen the nut, and inspect the ferrule for the correct position on the tubing.

Example of a perfect fitting



Examples of incorrect fittings

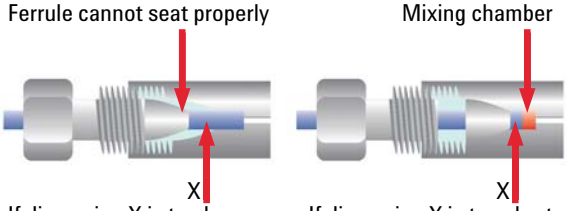


Figure 16 Examples of incorrect fittings

NOTE The first time that the swagelock fitting is used on a column or an injection valve, the position of the ferrule is permanently set. If changing from a column or an injection valve to another, the fitting may leak or decrease the quality of the separation by contributing to band broadening.

Setting up the Autosampler with Agilent Open Lab ChemStation

The setup of the Multisampler is shown with the Agilent OpenLab ChemStation C.01.06. Depending on the controller (e.g. Agilent Instant Pilot, OpenLab EZChrom, Masshunter) the screens look different.

NOTE This section describes the autosampler settings only. For information on the Agilent OpenLab ChemStation or other 1290 Infinity modules refer to the corresponding documentation.

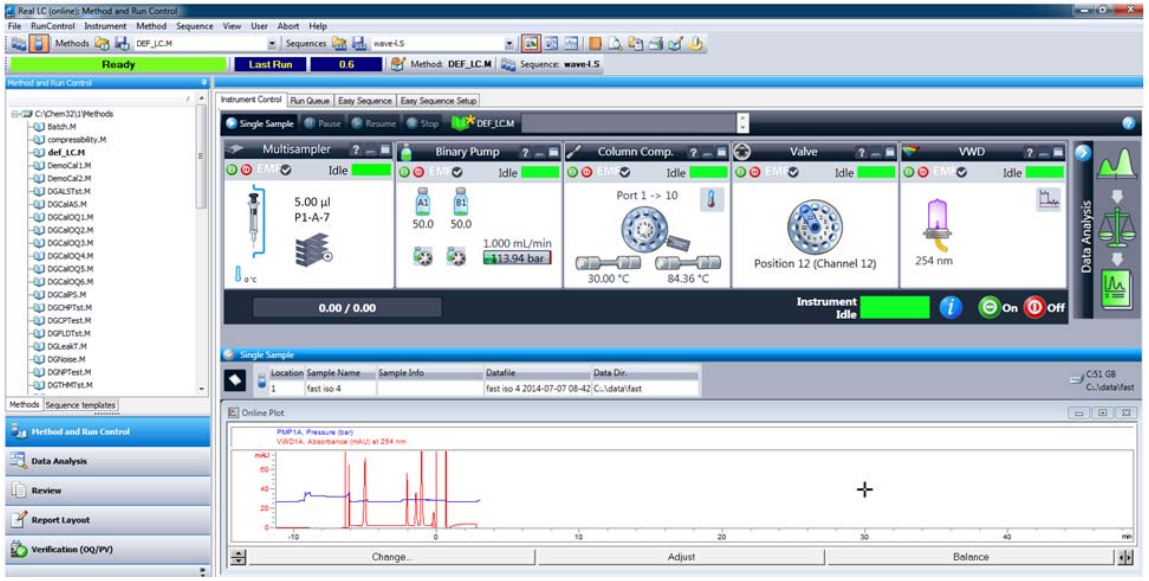
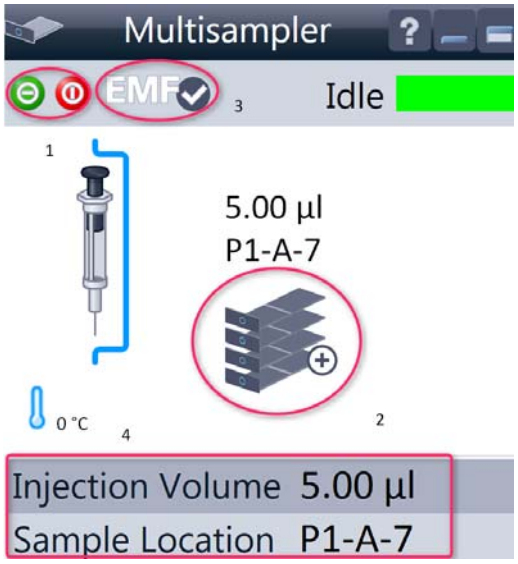


Figure 17 ChemStation Method and Run Control

After successful load of the OpenLab ChemStation, you should see the module as an active item in the graphical user interface (GUI).

Table 8 The Autosampler User Interface

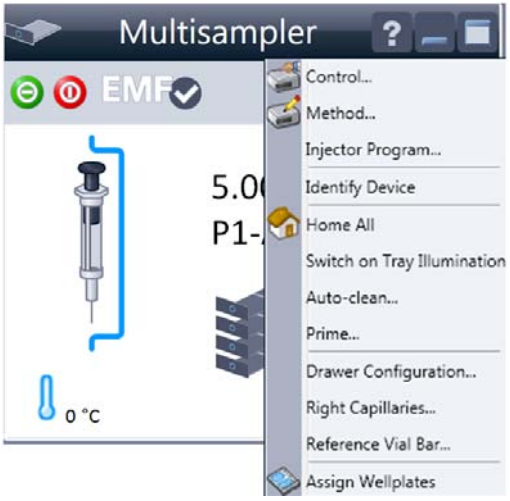


Within the Multisampler user interface, there are active areas. If you move the mouse cursor across the icons (tray, EMF button), the cursor will change and you may click on the icon to

1 Turn on/off the autosampler
2 Configure the sample hotel
3 Get the status of the **EMF** (Early Maintenance Feature)
4 Cooling Temperatur

Current instrument information on:

- **Injection volume**
- **Sample location**



A right-click into the Active Area will open a menu to

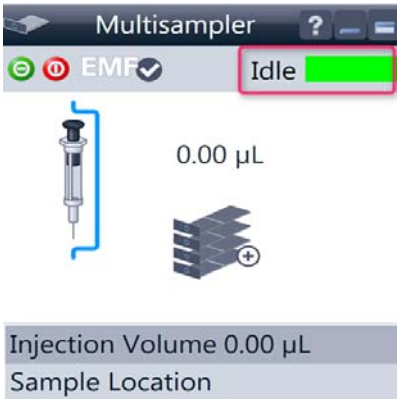
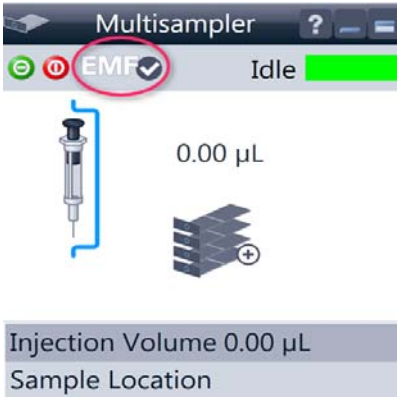
- Show the **Control** User Interface (special module settings)
- Show the **Method** User interface (same as via menu **Instrument > Set up Instrument Method > Setup G7167B**)
- **Injector Program**

  When you activate a pretreatment/injector program, it replaces the standard injection cycle.
- **Identify Device**
- **Home All**
- **Switch on Tray Illumination**
- **Auto Clean**
- **Prime**
- **Drawer Configuration**

  Changing the load capacity of the Sample Hotel
- **Right Capillaries**
- **Reference Vial Bar**
- **Assign Wellplates**

  Wellplate Configuration (same as click on the Tray icon)

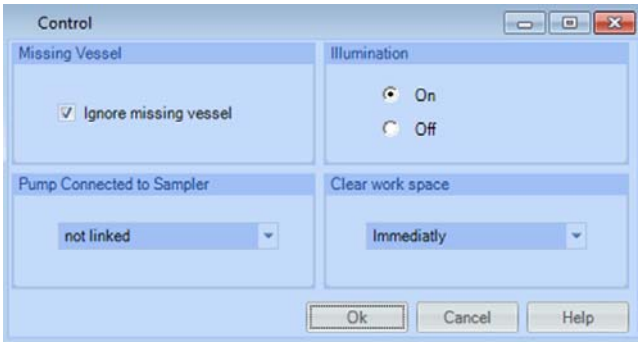
Table 8 The Autosampler User Interface

	**Module Status** shows Run / Ready / Error state and "Not Ready text" or "Error text" • **Error** (Red) • **Not ready** (yellow) • **Ready** (green) • **Pre run**, **Post run** (purple) • **Run** (blue) • **Idle** (green) • **Offline** (dark gray) • **Standby** (light gray)
	EMF Status shows Run / Ready / Error state and "Not Ready text" or "Error text" • Offline (gray) • Ok No Maintenance required (green) • EMF warning. Maintenance might be required (yellow) • EMF warning. Maintenance required (red)

Control Settings

These settings are available via right click on the Active Area of the ALS GUI.

Table 9 Control settings



Missing Vessel: The handling of missing vessels can be configured.
Illumination: Switch on/off the internal illumination
Linked Pump: To configure which pump delivers flow to the Autosampler
Prime Flush Pump: Priming the Needle wash flush pump
Work space: **Clear the workspace** > **Immediately**, **At the End of the Analysis** and **Never**

Method Parameter Settings

These settings are available via **Menu > Instrument > Set up Instrument Method Multisampler** or via right click on the Active area.

NOTE The signal window in the lower part is not shown when opening the parameter settings via right mouse on the Multisampler user interface.

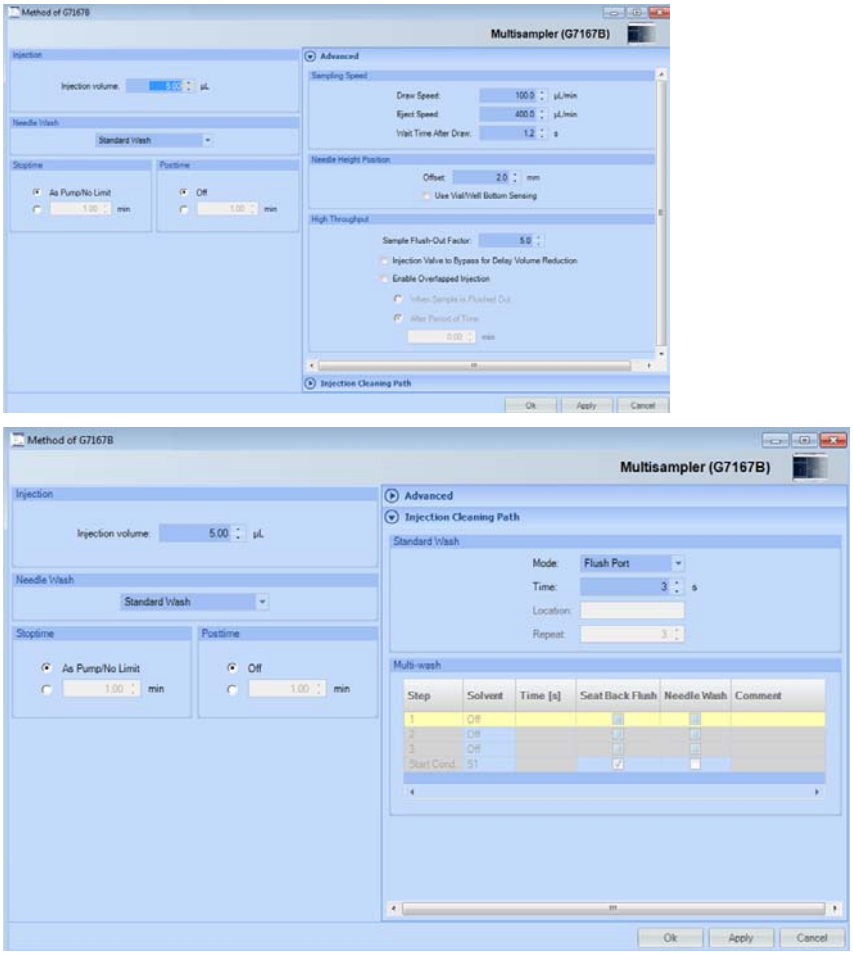
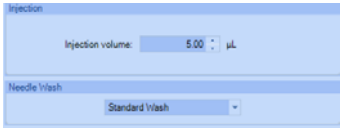
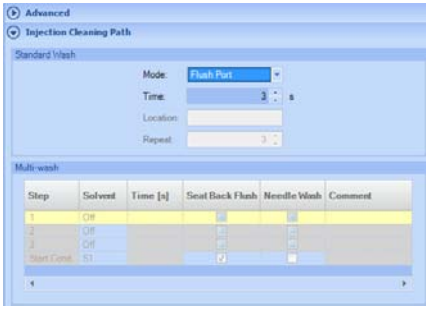


Figure 18 Method parameter settings

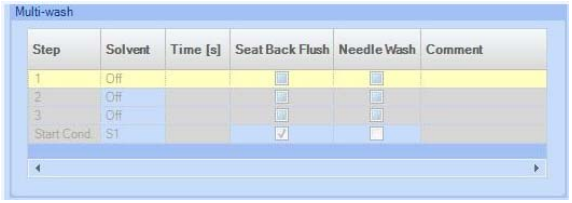
NOTE For additional help and support. Highlight the desired cell and press the **F1** key. A help screen will open with additional information and documentation about the topic.



Injection Mode/ Needle Wash
The settable **Injection volume** is depending on what kind of configuration is installed. Default configuration 0.1 – 20 µL.
It is possible to select between using the **Standard Wash** or **Standard Wash off**. Using needle wash is one option to obtain minimum carry-over.



The Injection cleaning section allows you to select between the **Standard Wash** option and the **Multi-wash** option. With the **Standard Wash** (default configuration) you can choose between two modes the Flush port or Wash Vial. If the **Multi-Wash** option is installed (additional hardware is required) you can use **Needle Wash** and **Seat Back Flush** together to obtain the lowest carry-over.

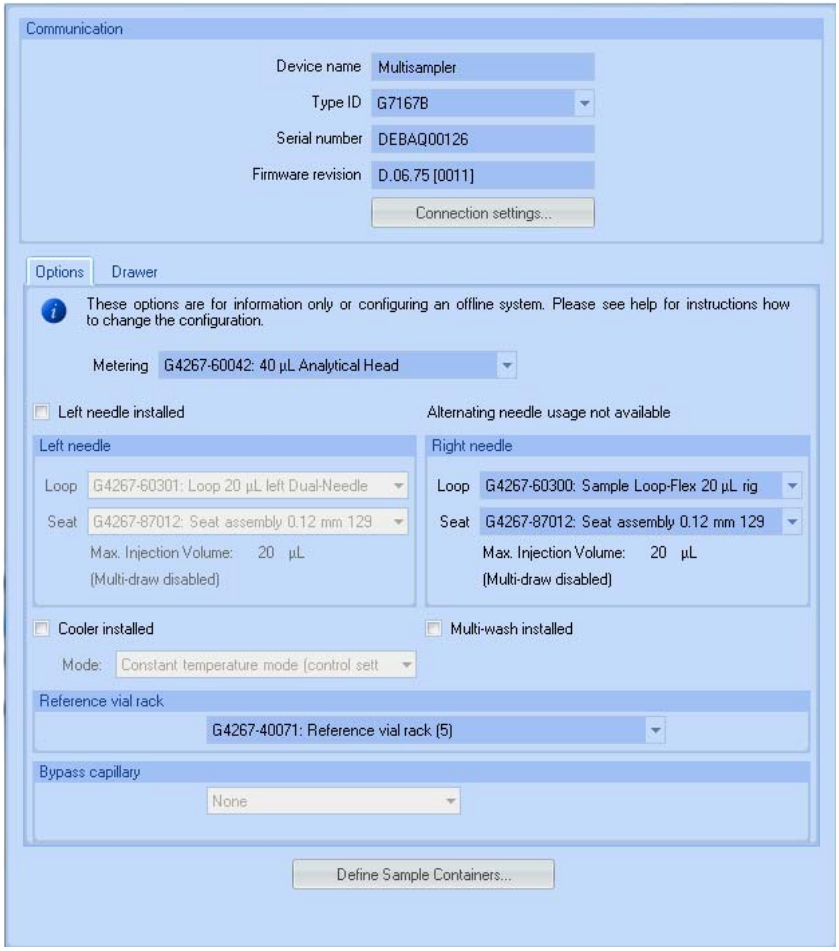


Multi-wash (Multisampler Injection Cleaning)
The Multi-wash table allows you to specify up to four steps that will be used to clean the system.
The Start Cond. step is not always executed. Therefore it is recommend to check the box to ensure that, at the end of the cleaning procedure, the flow path of the sampler is filled with the starting solvent conditions for the next sample.
For each cleaning step, Click the Solvent down arrow and select the solvent to use (S1, S2, S3) or switch the step Off.
Specify a duration (in seconds) in the Time [s] field.
Mark the check boxes for **Seat Back Flush** and/or **Needle Wash** to include these actions. If both are selected, they are carried out simultaneously; if neither is selected, the step is ignored (equivalent to selecting **Off**). Add a comment in the **Comment** column, if necessary.

Stoptime/Posttime
A Multisampler **Stoptime** can be set. For equilibration of the Multisampler a **Posttime** can be set.

Module Configuration View

The settings are available via menu **Instrument > Instrument Configuration > Multisampler Configuration**.

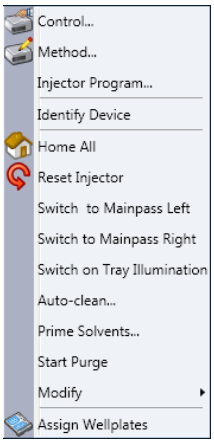


- **Device name**: based on the module.
- **Type ID**: based on the module (product number). Some modules may allow changing the type based on hardware/firmware. This results in a change of features and functions.
- **Serial number**: based on the module.
- **Firmware revision**: based on the module.
- **Options**: lists installed options.

Figure 19 Configuration view (single needle)

NOTE Changes in the sampler configuration can only be done in the online view of the CDS system, see Table 8 on page 78.

Setting up the Dual Needle System with Agilent OpenLAB ChemStation

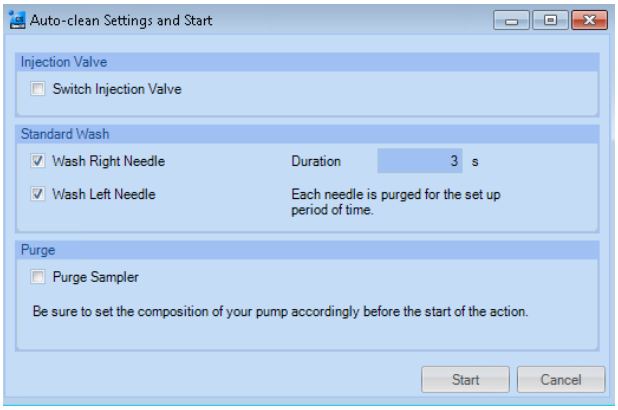


A right-click into the Active Area will open a menu to

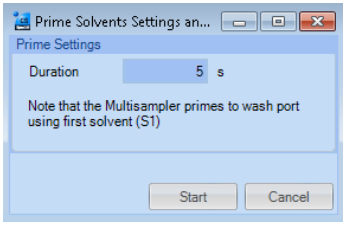
- Show the **Control** User Interface (special module settings)
- Show the **Method** User interface (same as via menu **Instrument > Set up Instrument Method > Setup G7167B**)
- **Injector Program**

  When you activate a pretreatment/injector program, it replaces the standard injection cycle.
- **Identify Device**
- **Home All**
- **Reset Injector**
- **Switch to Mainpass Left** (needle loop left is connected to the pump device)
- **Switch to Mainpass Right** (needle loop right is connected to the pump device)
- **Switch on Tray Illumination**

- **Auto-clean**



- **Prime Solvents**



- **Start Purge**:

  Manual start of the purge routine, duration defined by hydraulic setup. See “Purge” on page 87 for further information on purge.

- **Modify**
  - **Drawer Configuration**: Changing the load capacity of the Sample Hotel
  - **Capillaries Setup**: for the sample loops and seat capillaries for dual needle option
  - **Reference Vial Bar**
- **Assign Wellplates**

  Wellplate Configuration (same as click on the Tray icon)

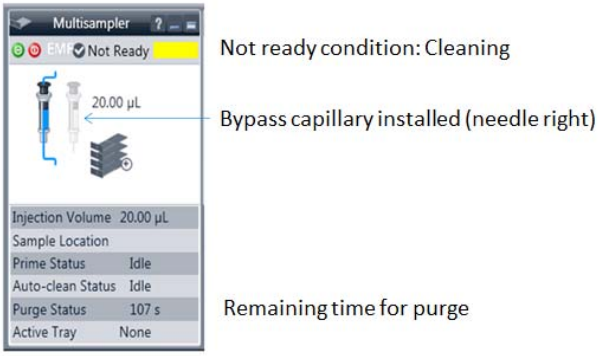
Purge

Typical time for purge:

- 1290 Binary pump, 2x 20 µL setup, flow rate: 0.5 mL/min ~ 125 s
- 1290 Binary pump, 2x 20 µL setup, flow rate: 1.0 mL/min ~ 85 s

Other configurations (especially large volume setups) will last longer.

In order to get information about remaining purge time, expand the window in the user interface:



NOTE The start of the pump or changes in solvent composition trigger the purge routine of the multisampler. The purge routine flushes the hydraulic setup of the multisampler with fresh mobile phase (for example metering device, sample loops, and needles). This ensures cleanness of the flowpath.

NOTE For pumps with a manual purge valve, it is mandatory to start the purge routine before a run or sequence. This will guarantee that the complete flow path of the dual needle setup is flushed with fresh mobile phase.

Modify Capillaries

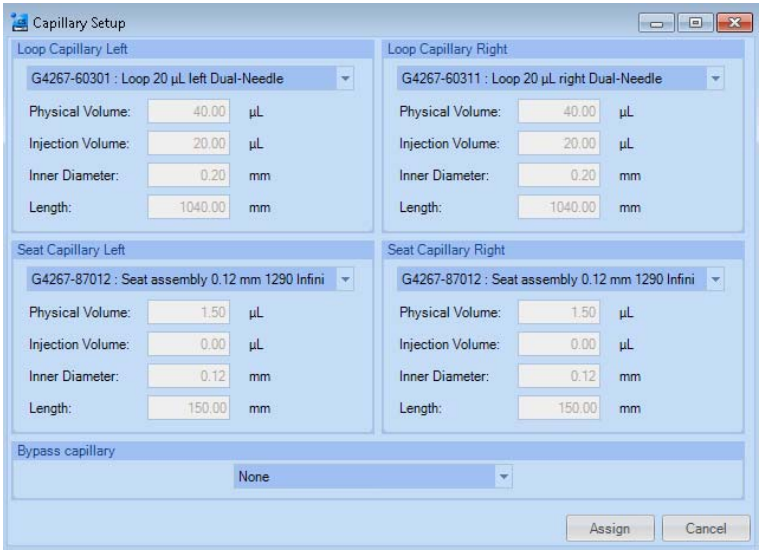


Figure 20 **Capillary Setup** for the Multisampler

NOTE To avoid damage of the system, the configuration of the dual-needle system must match to the installed hardware, especially the sample loops.

NOTE Only the listed capillary PN 5500-1238 can be used as bypass capillary (either left or right).

Instrument Configuration View

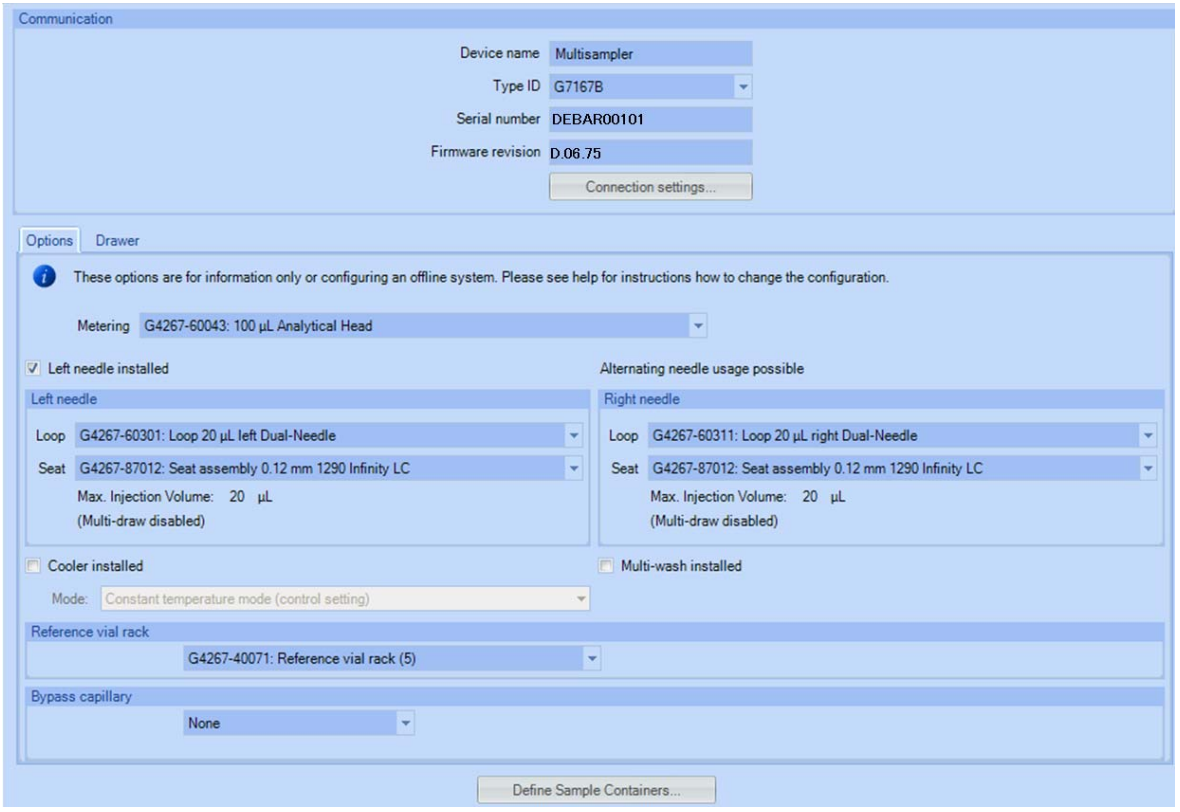


Figure 21 Configuration view for alternating dual needle with two 20 µL Sample Loops

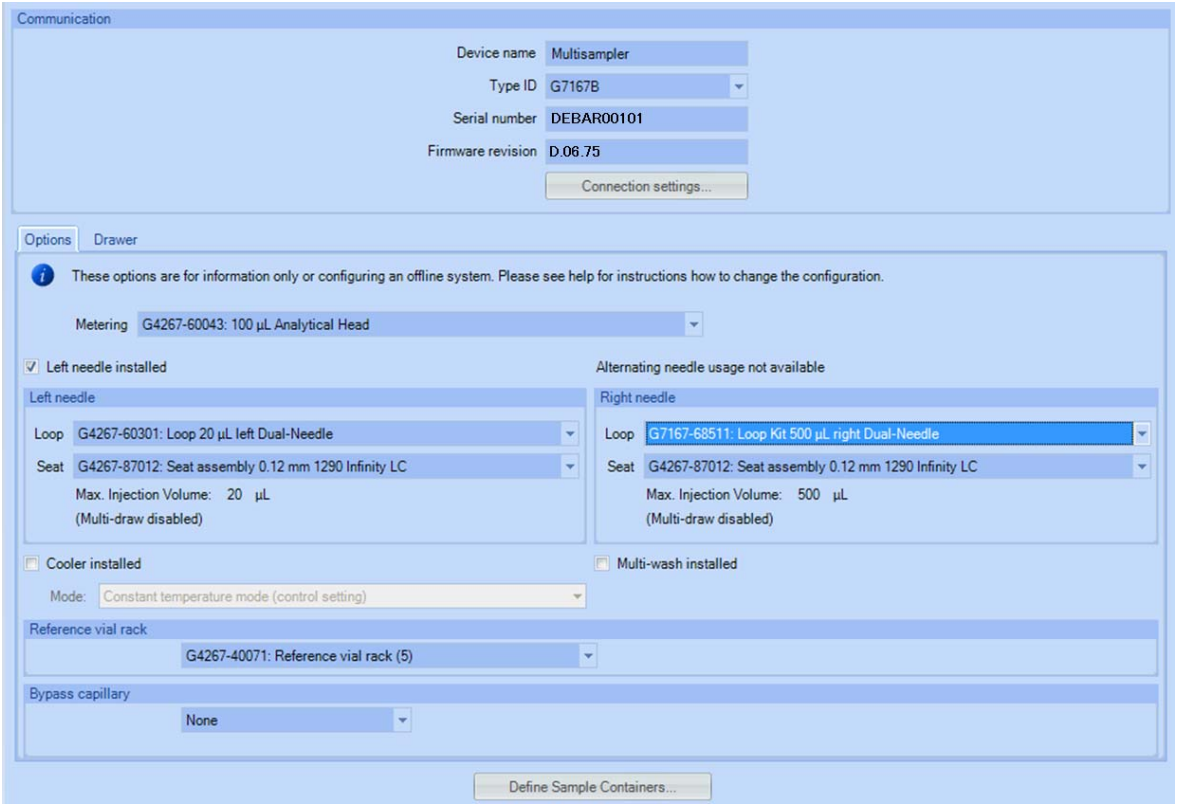


Figure 22 Configuration view for dual needle with non-identical flow paths (e.g a 20 µL and a 500 µL Sample Loop)

NOTE In this view it is not possible to change the online configuration of the sample loops or the seat capillaries.

Shows the currently installed devices and status.

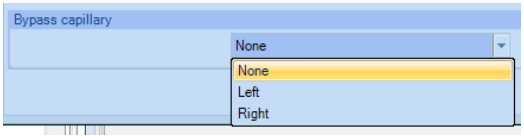
Table 10 Instrument configuration view

Communication	• **Device name**: Multisampler • **Type ID**: G7167A/B • **Serial number**: DEBAR00101 • **Firmware revision**: D.06.75 • **Connection settings**: LAN connection or hostname
Options	**Metering**: G4267-60043 100 µL Analytical Head NOTE This metering device is available only for a dual-needle Multisampler. You cannot use a 40 µL or 900 µL Analytical Head in this configuration.
Left Needle installed	This check box is marked to indicate that your system is equipped with a dual-needle option. When the check box is marked, the Left Needle section is enabled. NOTE If the Left Needle parameters are equivalent to the Right Needle parameters, then Alternating Needle Usage is possible, which increases sampling efficiency. NOTE If dual-needle option is installed, the system will use multi-load instead of multi-draw for larger sample volumes. For multi-wash and an installed dual-needle option, multi-draw is not available.
Left Needle	This section is enabled only when the Left Needle installed check box is marked.
Loop	Shows the currently installed loop capillary. NOTE It is mandatory that the configuration of the dual needle system, especially sample loops, match to the installed hardware to avoid damage to the system.
Seat	Shows the currently installed seat capillary.
Right Needle	This section is always enabled.

Table 10 Instrument configuration view

Loop	Shows the currently installed loop capillary. **NOTE** For the dual needle setup, only the correct dual needle sample loops must be configured and used, for instance Sample Loop 20 µL right Dual needle (G4267-60311). These sample loops are manufactured especially for dual-needle systems.
Seat	Shows the currently installed seat capillary. The needle seat capillary volume is used for the Automatic Delay Volume Reduction option and ISET.
Cooler installed	This check box is marked to show that a sample cooling device is installed.
Mode	Select **Constant temperature mode** to set the temperature using the Cooler section of the Multisampler Control parameters. Use this mode to store samples at a constant temperature across multiple runs. This is the default mode, which is recommended in most cases. Select **Variable temperature mode** to set the temperature using the Cooler section of the Advanced Method Setup parameters. In this mode, the temperature can be varied from run to run.
Multi-wash installed	This check box is marked to show that the multi-wash option is installed, and the Multi-wash option in the Needle Wash section of the Method parameters is available (*Not available for dual-needle*).
Reference vial rack	Click the down-arrow and select the reference vial rack that is installed in your multisampler from the drop-down list.

Table 10 Instrument configuration view

Bypass capillary	Click the down arrow and select where the bypass capillary is installed (if any). When installed, the bypass capillary allows the configuration of a minimized injection path to reduce flush times and allows the dual-needle configuration to be used in single-path mode. In this case, the needle where the bypass is installed is no longer available for injection.  **NOTE** Bypass capillary either installed left or right: only the listed capillary (p/n 5500-1238) can be used as bypass capillary.
Define Sample Containers	Displays the **Define and edit Wellplates configuration** dialog box, which contains a list of standard preconfigured wellplates plus any custom wellplates that have been added.

NOTE For the dual needle setup, only the correct hardware must be configured and used, for instance the Bypass capillary (5500-1238) or Sample Loop 20 µL right Dual needle (G4267-60311).

Method Setup

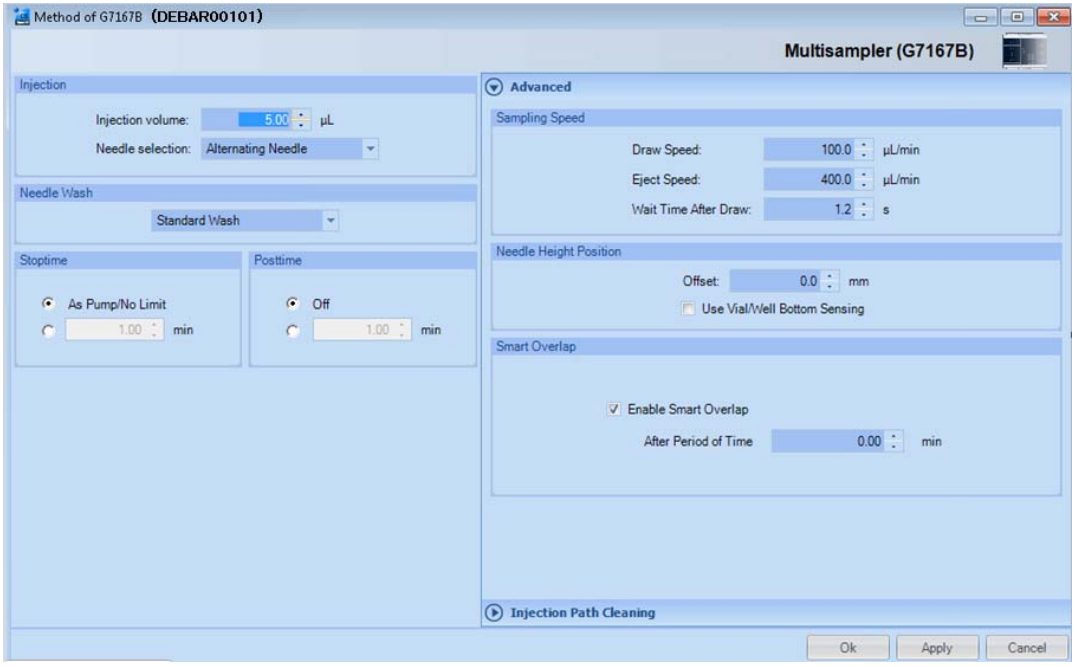


Figure 23 Method setup screen for Dual Needle option

Table 11 Method setup parameters (DN)

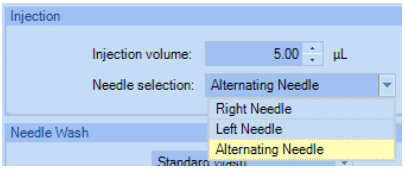
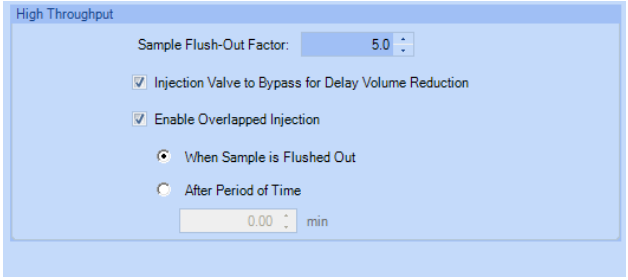
Injection	The Injection section allows you to specify the **Injection volume** and to select the needle
Needle selection	 • **Alternating Needle**: Needles will be toggled (only possible if the both flowpaths of are configured identically) • **Right Needle**: only the right needle will be used • **Left Needle**: only the left needle will be used
Needle Wash	The needle is washed in accordance with the parameters set up in the **Standard Wash** section of the Injection Path Cleaning section of the Method.
Stoptime	The **Stoptime** enables you to set the time that the analysis stops. Limits: 0.01 to 99999 min or **As Pump/No Limit**.
Posttime	You can set the **Posttime** so that your Multisampler remains in a post-run state during the **Posttime** to delay the start of the next analysis. A **Posttime** period can be used to allow your column to equilibrate after changes in solvent composition (for example after gradient elution). Limits: 0.01 to 99999 min or Off (0.0 min).
Sampling Speed	• **Draw Speed**: determines the rate at which the plunger draws sample from the vial. Set the speed to an appropriate value for your sample. For viscous samples, use a slow **Draw Speed**. • **Eject Speed**: determines the rate at which the plunger ejects sample from the metering device. If you are injecting large volumes of sample, setting a high **Eject Speed** will shorten the time needed for an injection cycle. For viscous samples, use a slow **Eject Speed**. • **Wait Time After Draw**: this time ensures that the temporary vacuum, which originates from the drawing of liquid from the sample vial, dissipates. The needle first stays on the seat for the specified time, then after drawing sample from the vial remains there for the specified time.

Table 11 Method setup parameters (DN)

Needle Height Position	• **Offset**: this is a vertical offset that enables you to position the needle a specific distance (in mm) away from its standard position. The **Offset** function is useful when analyzing very small sample volumes, or when only a specific part of the sample is required, for example, the top layer. Usually default draw offset = 0 equates to 2 mm above the wellplate bottom. • **Use Vial/Well Bottom Sensing**: this feature allows the needle to detect non-uniform well bottoms, and adjusts the depth of the needle position to 2 mm (default value) above the detected bottom of the vial or well. You can use **Vial/Well Bottom Sensing** in combination with the **Offset** to customize the draw position of the needle.To turn on **Vial/Well Bottom Sensing**, mark the check box. The default setting is cleared. You may want to turn off **Vial/Well Bottom Sensing** to increase speed of injection, or to avoid the needle touching the bottom of the well if a sample precipitate could clog it.
Smart Overlap	• **Enable Smart Overlap**: Overlapped injection provides faster throughput of samples by allowing the preparation of the next injection while the current injection is in the mainpass. This section is available only for a dual-needle Multisampler with identical left and right flow paths (Seat capillary and Loop capillary), and **Alternating Needle** selected in the **Injection** section of the method setup. • **After Period of Time**: specifies the time (in minutes) that the Multisampler waits after injection of a sample before taking up and injecting the next sample. **NOTE** It is important to calculate the time close to the start point of the next run to avoid waiting time with filled sample loop.

High Throughput

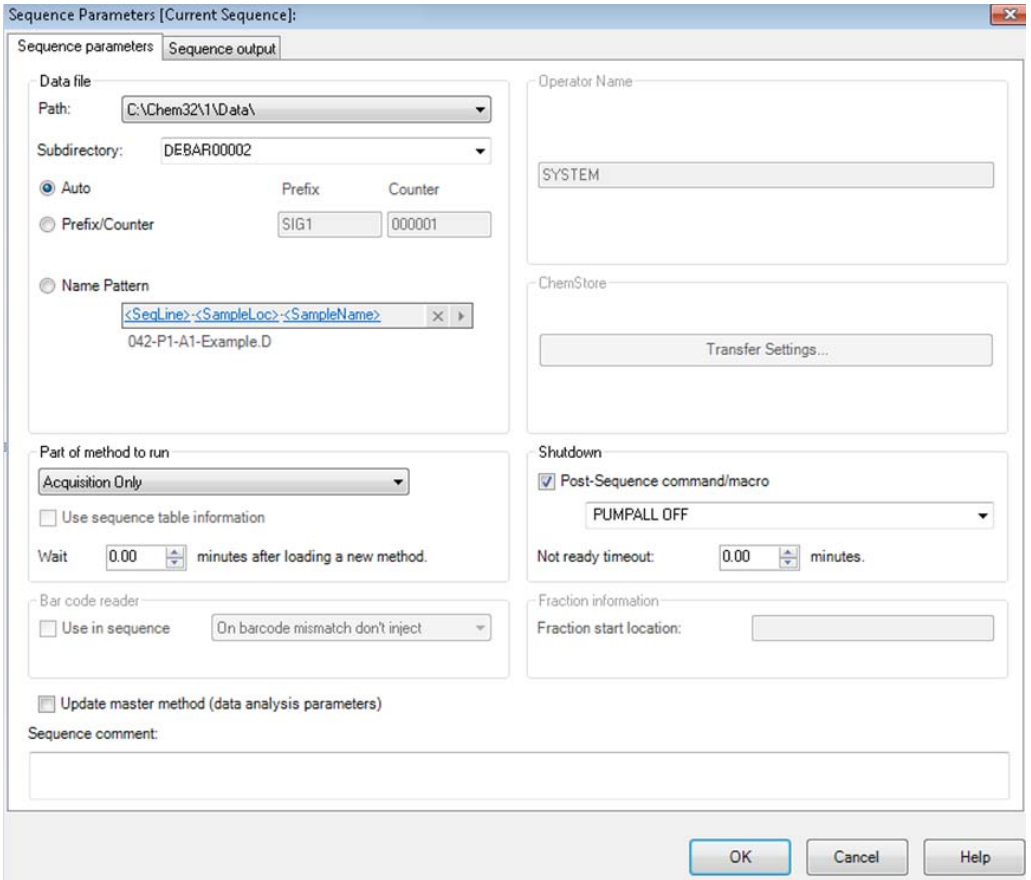


NOTE This section is available only for a dual-needle Multisampler with different seat-capillary and loop-capillary volumes, and either **Right Needle** or **Left Needle** selected in the **Injection** section of the method setup.

Table 12 High throughput

Sample Flush-Out Factor	The **Sample Flush-Out Factor** ensures that the sample is thoroughly flushed out of the sample loop and needle after switching into the mainpass. The factor is part of the flush-out volume formula, which is calculated by the Multisampler firmware. The volume is calculated as: factor x (injection volume + seat capillary volume + valve volume). The **Sample Flush-Out Factor** is preset to 5.0 at the factory. The preset **Sample Flush-Out Factor** is correct for most methods. However, for unusually viscous samples, you should increase the **Sample Flush-Out Factor** to obtain the desired degree of flushing in order to prevent sample carry-over.
Injection Valve to Bypass for Delay Volume Reduction	This parameter is used to switch the flow from the injector from mainpass to bypass after injection has taken place. This reduces the delay volume for low volume techniques. You can specify the point during the analyses when the valve switches to bypass. This is done by setting the **Sample Flush-out Factor**.
Enable Overlapped Injection	Overlapped injection provides faster throughput of samples by allowing the preparation of the next sample during analysis of the injected sample.

Sequence Parameters



Not ready timeout: the time in minutes has to be longer than the purge routine lasts - otherwise the run will be aborted before start.

5 Optimizing Performance

Delay Volume and Extra-Column Volume 100
Delay Volume 100
How to Configure the Optimum Delay Volume 101
How to Achieve Higher Injection Volumes 106
How to Achieve High Throughput 108
How to Achieve Higher Resolution 109
How to Achieve Higher Sensitivity 112
How to Achieve Lowest Carry Over 113

This chapter gives hints on how to optimize the performance or use additional devices.

Delay Volume and Extra-Column Volume

The *delay volume* is defined as the system volume between the point of mixing in the pump and the top of the column.

The *extra-column volume* is defined as the volume between the injection point and the detection point, excluding the volume in the column.

Delay Volume

In gradient separations, this volume causes a delay between the mixture changing in the pump and that change reaching the column. The delay depends on the flow rate and the delay volume of the system. In effect, this means that in every HPLC system there is an additional isocratic segment in the gradient profile at the start of every run. Usually the gradient profile is reported in terms of the mixture settings at the pump and the delay volume is not quoted even though this will have an effect on the chromatography. This effect becomes more significant at low flow rates and small column volumes and can have a large impact on the transferability of gradient methods. It is important, therefore, for fast gradient separations to have small delay volumes, especially with narrow bore columns (e.g., 2.1 mm i.d.) as often used with mass spectrometric detection.

How to Configure the Optimum Delay Volume

For very fast gradients over 0.5 min the delay volume of the system can be easily reduced without changing the physical configuration of the system. The change is achieved by changing the behavior of the multisampler. The 180 µL delay volume of the autosampler is due to the flow path from the injection valve through the metering device, needle, needle seat and connecting capillaries back to the injection valve (see Table 13 on page 102). To make an injection the valve switches from mainpass to bypass so that the metering device can draw the sample into the needle capillary. The injection is made when the valve switches back to mainpass and the sample is flushed onto the column. The valve remains in this position during analysis so that the autosampler is continually flushed and hence the gradient has to flow through this delay volume to reach the column. This can be eliminated by switching the injection valve from mainpass to bypass after the injection has been made and the injected sample has been flushed onto the column. In practice this can be done a few seconds after injection and is activated by selecting the **Automatic Delay Volume Reduction** (ADVR) function in the autosampler setup menu. The Flush-out Factor (typically 5 times injection volume) ensures that enough time is allowed to flush the sample out of the injector before switching to bypass. For instance a 1 µL injection under standard conditions effectively reduces the system delay volume by approximatly 160 µL.

Table 13 Schematic of injection steps in 1290 Infinity II Multisampler (Single needle)

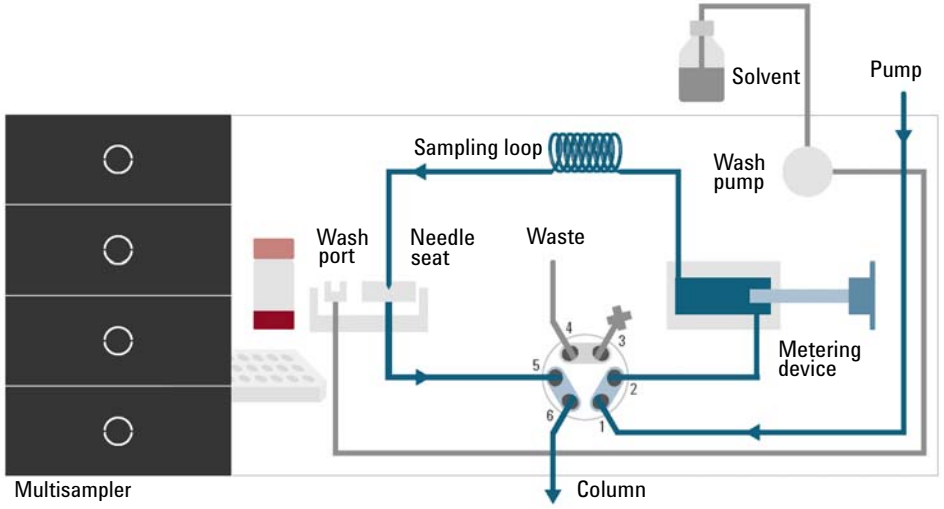


Figure 24 Valve in mainpass, flow through

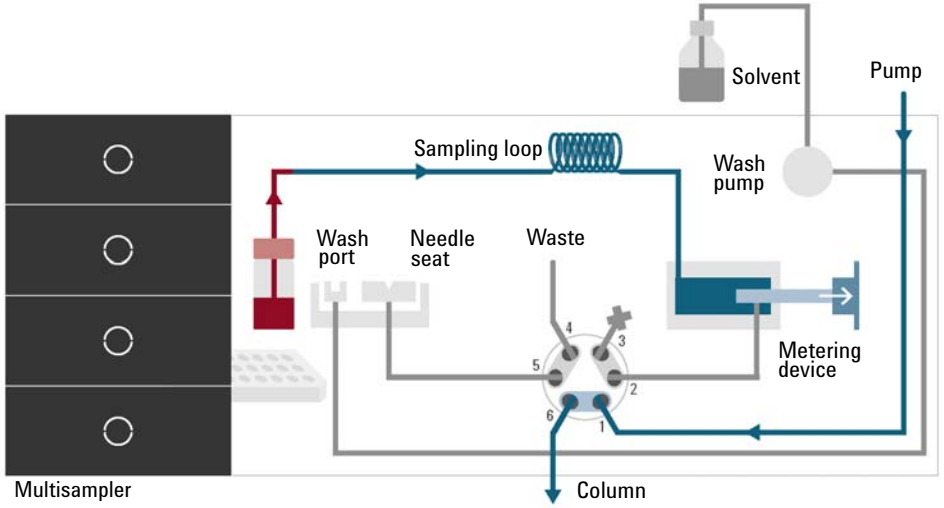


Figure 25 Valve in bypass, drawing sample

Table 13 Schematic of injection steps in 1290 Infinity II Multisampler (Single needle)

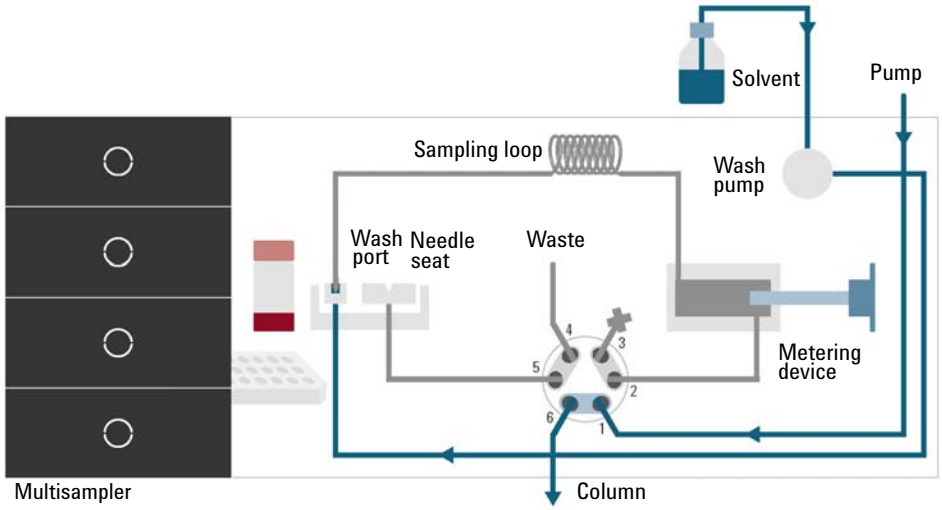


Figure 26 Valve in bypass, washing needle

Table 13 Schematic of injection steps in 1290 Infinity II Multisampler (Single needle)

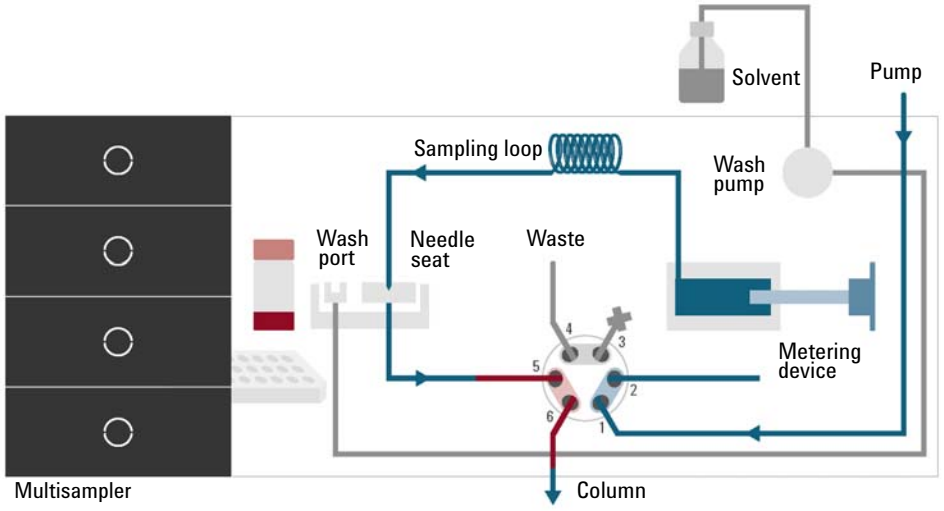


Figure 27 Valve in mainpass, sample injected

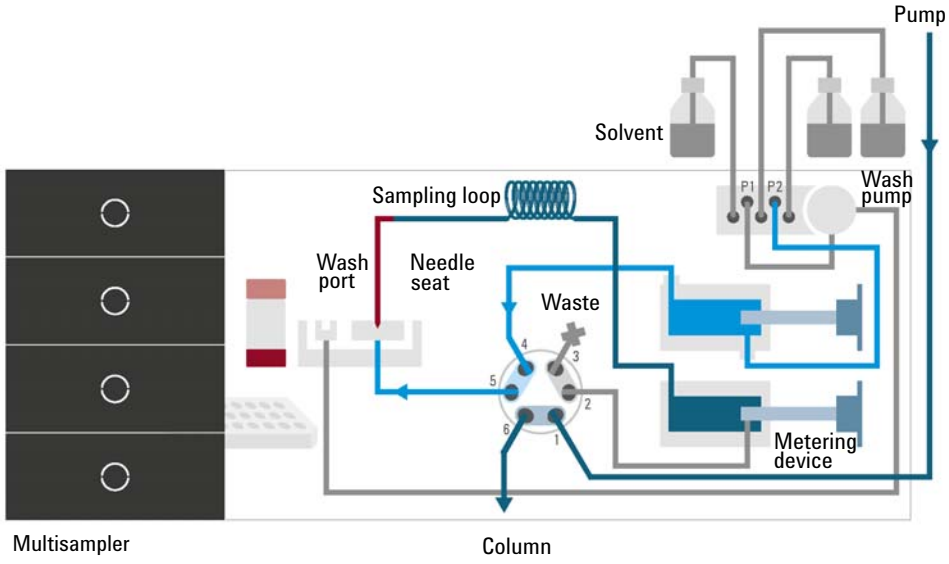


Figure 28 Valve in bypass, needle backflush (Multiwash)

When using ADVR it should be noted that the gradient has already started at the pump at the instant of injection. The question should be asked whether the gradient has already reached the autosampler, in which case a small step in the gradient will result. This happens when the delay volume is less than the flush-out volume and is not necessarily a problem but may be a factor to be considered in a method transfer. With a flush-out factor of 5 and an injection volume of 10 µl, the autosampler will allow 50 µl to pass through before switching to bypass which, with a delay volume of 50 µl, means the gradient just reached the injection valve. Smaller injection volumes will have no effect but for larger injection volumes this will introduce a small step in the gradient. The flow rate in use will also have an impact on the decision to use ADVR or not. At 0.2 ml/min the delay time saved is 21 seconds while at 1.0 ml/min it is 4 seconds.

The ADVR function is unlikely to be suitable for applications involving compounds which are known to cause carry-over problems. The best solution to reduce the delay volume is to install the 40 µL Analytical Head and the 20 µL Loop. To get the best results it is also recommended to order the Low dispersion heat exchanger and the micro flow cell for UV. This will reduce the the delay volume by 120 µL.

How to Achieve Higher Injection Volumes

The standard configuration of the Multisampler can inject a maximum volume of 20 µL with the standard loop capillary. To increase the injection volume the Multidraw upgrade kit (G4216-68711) can be installed. With this kit you can add a maximum of 80 µL to the injection volume of your injector. The total volume for the standard Multisampler is then 100 µL or 120 µL depending on the loop size with 40 µL analytical head installed.

For higher injection volume you can choose between further options. This requires additional hardware modifications. One way to increase the injection volume is to change the analytical head volume. There are a 100 µL and 900 µL analytical heads available. Additional you can install the Multidraw kit (G7167-68711). With the kit you can add a maximum of 400 µL or 1400 µL to the injection volume of your injector. The total volume is then 500 µL or 1500 µL for the Multisampler with a 100 µL analytical head setup. Note the delay volume of your Multisampler is extended when using the extended seat capillaries fromthe multi-draw kit. When calculating the delay volume of the Multisampler you have to double the volume of the extended capillaries. The system delay volume due to the Multisampler will increase accordingly.

Whenever a method is scaled down from a larger column to a smaller column it is important that the method translation makes an allowance for reducing the injection volume in proportion to the volume of the column to maintain the performance of the method. This is to keep the volume of the injection at the same percentage volume with respect to the column. This is particular important if the injection solvent is stronger (more eluotropic) than the starting mobile phase and any increase will affect the separation particularly for early running peaks (low retention factor). In some cases it is the cause of peak distortion and the general rule is to keep the injection solvent the same or weaker than the starting gradient composition. This has a bearing on whether, or by how much, the injection volume can be increased and the user should check for signs of increased dispersion (wider or more skewed peaks and reduced peak resolution) in trying to increase the injection size. If an injection is made in a weak solvent then the volume can probably be increased further because the effect will be to concentrate the analyte on the head of the column at the start of the gradient. Conversely if the injection is in a stronger solvent than the starting mobile phase then increased injection volume will spread

the band of analyte down the column ahead of the gradient resulting in peak dispersion and loss of resolution.

Perhaps the main consideration in determining injection volume is the diameter of the column as this will have a big impact on peak dispersion. Peak heights can be higher on a narrow column than with a larger injection on a wider column because there is less peak dispersion. With 2.1 mm i.d. columns typical injection volumes might range up to 5 to 10 µL but it is very dependent on the chemistry of the analyte and mobile phase as discussed above. In a gradient separation injection volumes of about 5 % of the column volume might be achieved whilst maintaining good resolution and peak dispersion. One way to achieve larger injections is to use a trapping column selected by a switching valve to capture and concentrate the injection before switching it, i.e. injecting it, onto an analytical column, see Figure 29 on page 107. The valve can be conveniently located in the Multicolumn Thermostat.

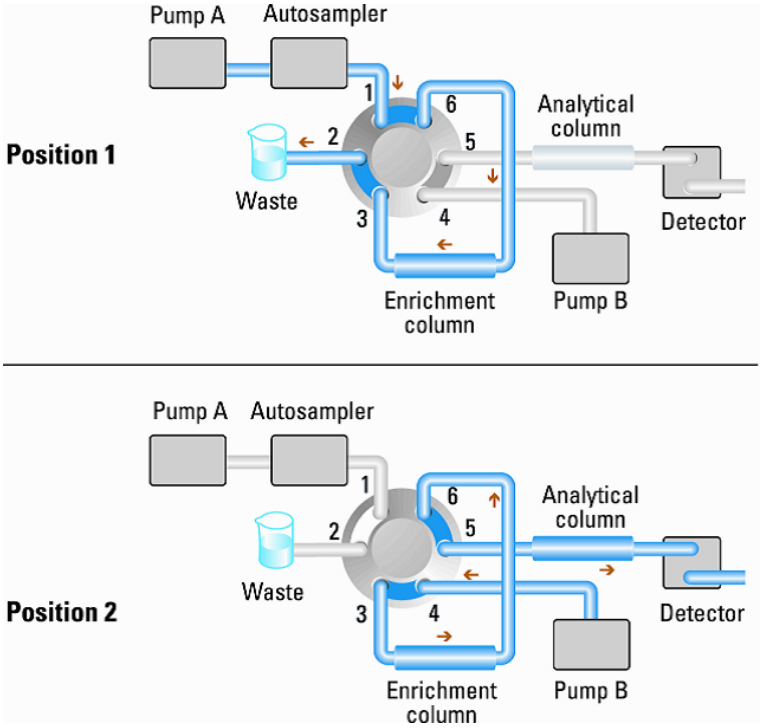


Figure 29 Sample enrichment

How to Achieve High Throughput

The injection can be optimized for speed remembering that drawing the sample too fast can reduce the reproducibility. Marginal gains are to be made here as the sample volumes used tend towards the smaller end of the range in any case. A significant portion of the injection time is the time taken with the needle movements to and from the vial and into the flush port. These manipulations can be performed while the previous separation is running. This is known as *overlapped injection* and it can be easily turned on from the Multisampler setup screen in the control software. The Multisampler can be told to switch the flow through the Multisampler to bypass after the injection has been made and then after, for example, 3 minutes into a 4 minutes run to start the process of aspirating the next sample and preparing for injection. This can typically save 0.5 to 1 minute per injection.

How to Achieve Higher Resolution

Increased resolution in a separation will improve the qualitative and quantitative data analysis, allow more peaks to be separated or offer further scope for speeding up the separation. This section explains how resolution can be increased by examining the following points:

- Optimize selectivity
- Smaller particle-size packing
- Longer Columns
- Shallower gradients, faster flow

Resolution between two peaks is described by the resolution equation:

$$Rs = \frac{1}{4}\sqrt{N}\,\frac{(\alpha - 1)}{\alpha}\,\frac{(k_2 + 1)}{k_2}$$

where

- R_S=resolution,
- N=plate count (measure of column efficiency),
- α=selectivity (between two peaks),
- k_2=retention factor of second peak (formerly called capacity factor).

The term that has the most significant effect on resolution is the selectivity, α, and practically varying this term involves changing the type of stationary phase (C18, C8, phenyl, nitrile etc.), the mobile phase and temperature to maximize the selectivity differences between the solutes to be separated. This is a substantial piece of work which is best done with an automated method development system which allows a wide range of conditions on different columns and mobile phases to be assessed in an ordered scouting protocol. This section considers how to get higher resolution with any chosen stationary and mobile phases. If an automated method development system was used in the decision on phases it is likely that short columns were used for fast analysis in each step of the scouting.

The resolution equation shows that the next most significant term is the plate count or efficiency, N, and this can be optimized in a number of ways. N is inversely proportional to the particle size and directly proportional to the length of a column and so smaller particle size and a longer column will give a higher plate number. The pressure rises with the inverse square of the particle size and proportionally with the length of the column. This is the reason that the 1290 Infinity LC system was designed to go to 1200 bar so that it can run sub-two-micron particles and column length can be increased to 100 mm or 150 mm. There are even examples of 100 mm and 150 mm columns linked to give 250 mm length. Resolution increases with the square root of N so doubling the length of the column will increase resolution by a factor of 1.4. What is achievable depends on the viscosity of the mobile phase as this relates directly to the pressure. Methanol mixtures will generate more back pressure than acetonitrile mixtures. Acetonitrile is often preferred because peak shapes are better and narrower in addition to the lower viscosity but methanol generally yields better selectivity (certainly for small molecules less than about 500 Da). The viscosity can be reduced by increasing the temperature but it should be remembered that this can change the selectivity of the separation. Experiment will show if this leads to increase or decrease in selectivity. As flow and pressure are increased it should be remembered that frictional heating inside the column will increase and that can lead to slightly increased dispersion and possibly a small selectivity change both of which could be seen as a reduction in resolution. The latter case might be offset by reducing the temperature of the thermostat by a few degrees and again experiment will reveal the answer.

The van Deemter curve shows that the optimum flow rate through an STM column is higher than for larger particles and is fairly flat as the flow rate increases. Typical, close to optimum, flow rates for STM columns are: 2 ml/min for 4.6 mm i.d.; and 0.4 ml/min for 2.1 mm i.d. columns.

In isocratic separations, increasing the retention factor, k, results in better resolution because the solute is retained longer. In gradient separations the retention is described by k^* in the following equation:

$$k^* = \frac{t_G}{\Delta\%B} \cdot \frac{F}{V_m} \cdot \frac{100}{S}$$

where:

- k^* = mean k value,
- t_G = time length of gradient (or segment of gradient) (min),
- F = flow (ml/min),
- V_m = column delay volume,
- Δ%B = change in fraction of solvent B during the gradient,
- S = constant (ca. 4-5 for small molecules).

This shows that k and hence resolution can be increased by having a shallower gradient (2 to 5 %/min change is a guideline), higher flow rate and a smaller volume column. This equation also shows how to speed up an existing gradient – if the flow is doubled but the gradient time is halved, k^* remains constant and the separation looks the same but happens in half the time. Recently published research has shown how a shorter STM column (at temperatures above 40 °C) can generate higher peak capacity than a longer STM column by virtue of running it faster. (Refer to *Petersson et al., J.Sep.Sci, 31, 2346-2357, 2008, Maximizing peak capacity and separation speed in liquid chromatography*).

How to Achieve Higher Sensitivity

The sensitivity of a separation method is linked to the choice of stationary and mobile phases as good separation with narrow peaks and a stable baseline with minimal noise are desirable. The choice of instrument configuration will have an effect and a major impact is the setup of the detector. This section considers how sensitivity is affected by:

- Pump mixer volume
- Narrower columns
- Detector flow cell
- Detector parameters

In addition, the discussion on detector parameters also mentions the related topics of selectivity and linearity.

Columns

Sensitivity is specified as a signal-to-noise ratio (S/N) and hence the need to maximize peak height and minimize baseline noise. Any reduction in peak dispersion will help to maintain peak height and so extra-column volume should be minimized by use of short, narrow internal diameter, connection capillaries and correctly installed fittings. Using smaller inner diameter columns should result in higher peak height and is therefore ideal for applications with limited sample amounts. If the same sample amount can be injected on a smaller i.d. column, then the dilution due to column diameter will be less and the sensitivity will increase. For example, decreasing the column i.d. from 4.6 mm to 2.1 mm results in a theoretical gain in peak height of 4.7 times due to the decreased dilution in the column. For a mass spectrometer detector, the lower flow rates of narrow columns can result in higher ionization efficiencies and therefore higher sensitivity.

How to Achieve Lowest Carry Over

Carryover is measured when residual peaks from a previous active-containing injection appear in a subsequent blank solvent injection. There will be carry over between active injections which may lead to erroneous results. The level of carryover is reported as the area of the peak in the blank solution expressed as a percentage of the area in the previous active injection. The Multisampler is optimized for lowest carryover by careful design of the flow path and use of materials in which sample adsorption is minimized. A carryover figure of 0.001 % should be achievable even when a triple quadrupole mass spectrometer is the detector. Operating settings of the Multisampler allow the user to set appropriate parameters to minimize carryover in any application involving compounds liable to stick in the system. The following functions of the Multisampler can be used to minimize carryover:

- Internal needle wash
- External needle wash
- Needle seat backflush
- Injection valve cleaning

The flow path, including the inside of the needle, is continuously flushed in normal operation, providing good elimination of carryover for most situations. Automated delay volume reduction (ADVR) will reduce the delay volume but will also reduce the flushing of the Standard Multisampler and should not be used with analytes where carryover might be a problem.

The outside of the needle can be washed using a wash vial in a specific location or the needle can be washed using the flush port. If a wash vial in a tray location specified by the user is chosen then this vial should have no septum and should contain a solvent suitable for washing the sample from the needle. The septum is not used to avoid wiping contamination off the needle on the downstream only to re-apply it on the upstroke. The needle can be dipped into the vial multiple times. This will be effective in removing a small degree of carryover but for more effective washing of the outside of the needle use the flushport.

The flush port is located above and behind the needle seat and in the standard hardware configurationa peristaltic pump delivers the wash solvent. It has a volume of 0.68 mL and the peristaltic pump delivers 5 mL/min, which means the flush port volume is completely refilled with fresh solvent in 7 s.

If the flush port is selected, the user can set how long the outside of the needle is to be washed with fresh solvent. This can last two or three seconds in routine situations where carryover is less of a problem and 10 – 20 s for more complete washing.

It is recommended that washing the outside of the needle in the flush port should be standard procedure to avoid contaminating the needle seat. If the needle seat becomes contaminated it will have to be back-flushed. In the standard setup it must be done by manually changing the flow connections to clean it.

In this standard configuration the task can be done automated by using the Flexible Cube module. If you have installed the Multisampler with Multi-Wash option the flushport will be primed with a micro piezo pump. This pump can choose between 3 different wash solvents.

The flush port and its solvent delivery pump and tubing should be regularly flushed to ensure the lowest carryover. For example, before using the system each day, prime the flush pump for three minutes with appropriate solvent.

When other measures have failed to eliminate carryover it might be that analyte is sticking inside the injector valve. With auto clean feature in the CDS system the injector valve can be set to make additional switching movements to clean out the flow path in the valve if problems occur here with carryover. If the problem compounds need a high percentage of organic phase for elution, it is recommended to switch the injection valve at the high percentage of organic phase after the last peak has eluted. It is also recommended to switch the injection valve again after the initial conditions for the mobile phase have stabilized. This ensures that the bypass groove in the rotor seal of the valve contains the gradient start conditions, which is especially important for flow rates below 0.5 mL/min. For samples where the outside of the needle cannot be cleaned sufficiently with water or alcohol from the flush pump use wash vials with an appropriate solvent. With an injector program several wash vials can be used for cleaning.

The optimum carry-over performance of the Multisampler is achieved after a run-in period of new instruments or after the exchange of consumable parts (like needle, needle seat and valve parts). During injections in this period, surfaces of these parts adjust to each other. After this period, we recommend back-flushing the needle seat in order to get the sealing areas between needle and needle seat clean. Regular Preventive Maintenance service is recommended as the carry-over performance of the Autosampler depends on the integrity of these consumable parts.

6
Troubleshooting and Diagnostics

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Agilent Lab Advisor Software 119

This chapter gives an overview about the troubleshooting and diagnostic features and the different user interfaces.

User Interfaces

- Depending on the user interface, the available tests and the screens/reports may vary.
- Preferred tool should be Agilent Lab Advisor Software, see "Agilent Lab Advisor Software" on page 119.
- The Agilent OpenLab ChemStation C.01.03 and above do not include any maintenance/test functions.
- Screenshots used within these procedures are based on the Agilent Lab Advisor Software.

Agilent Lab Advisor Software

The Agilent Lab Advisor Software is a standalone product that can be used with or without chromatographic data system. Agilent Lab Advisor helps to manage the lab for high-quality chromatographic results by providing a detailed system overview of all connected analytical instruments with instrument status, Early Maintenance Feedback counters (EMF), instrument configuration information, and diagnostic tests. By the push of a button, a detailed diagnostic report can be generated. Upon request, the user can send this report to Agilent for a significantly improved troubleshooting and repair process.

The Agilent Lab Advisor software is available in two versions:

- Lab Advisor Basic
- Lab Advisor Advanced

Lab Advisor Basic is included with every Agilent 1200 Infinity Series and Infinity II Series pump.

The Lab Advisor Advanced features can be unlocked by purchasing a license key, and include real-time monitoring of instrument actuals, all various instrument signals, and state machines. In addition, all diagnostic test results, calibration results, and acquired signal data can be uploaded to a shared network folder. The Review Client included in Lab Advisor Advanced allows to load and examine the uploaded data no matter on which instrument it was generated. This makes Data Sharing an ideal tool for internal support groups and users who want to track the instrument history of their analytical systems.

The optional Agilent Maintenance Wizard Add-on provides an easy-to-use, step-by-step multimedia guide for performing preventive maintenance on Agilent 1200 Infinity and Infinity II Series instruments.

The tests and diagnostic features that are provided by the Agilent Lab Advisor software may differ from the descriptions in this manual. For details, refer to the Agilent Lab Advisor software help files.

7
Error Information

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This chapter describes the meaning of error messages, and provides information on probable causes and suggested actions how to recover from error conditions.

What Are Error Messages

Error messages are displayed in the user interface when an electronic, mechanical, or hydraulic (flow path) failure occurs which requires attention before the analysis can be continued (for example, repair, or exchange of consumables is necessary). In the event of such a failure, the red status indicator at the front of the module is switched on, and an entry is written into the module logbook.

If an error occurs outside a method run, other modules will not be informed about this error. If it occurs within a method run, all connected modules will get a notification, all LEDs get red and the run will be stopped. Depending on the module type, this stop is implemented differently. For example, for a pump the flow will be stopped for safety reasons. For a detector, the lamp will stay on in order to avoid equilibration time. Depending on the error type, the next run can only be started, if the error has been resolved, for example liquid from a leak has been dried. Errors for presumably single time events can be recovered by switching on the system in the user interface.

Special handling is done in case of a leak. As a leak is a potential safety issue and may have occurred at a different module from where it has been observed, a leak always causes a shutdown of all modules, even outside a method run.

In all cases, error propagation is done via the CAN bus or via an APG/ERI remote cable (see documentation for the APG/ERI interface).

General Error Messages

General error messages are generic to all Agilent series HPLC modules and may show up on other modules as well.

Timeout

Error ID: 0062

The timeout threshold was exceeded.

Probable cause	Suggested actions
1 The analysis was completed successfully, and the timeout function switched off the module as requested.	Check the logbook for the occurrence and source of a not-ready condition. Restart the analysis where required.
2 A not-ready condition was present during a sequence or multiple-injection run for a period longer than the timeout threshold.	Check the logbook for the occurrence and source of a not-ready condition. Restart the analysis where required.

Shutdown

Error ID: 0063

An external instrument has generated a shutdown signal on the remote line.

The module continually monitors the remote input connectors for status signals. A LOW signal input on pin 4 of the remote connector generates the error message.

Probable cause	Suggested actions
1 Leak detected in another module with a CAN connection to the system.	Fix the leak in the external instrument before restarting the module.
2 Leak detected in an external instrument with a remote connection to the system.	Fix the leak in the external instrument before restarting the module.
3 Shut-down in an external instrument with a remote connection to the system.	Check external instruments for a shut-down condition.
4 The degasser failed to generate sufficient vacuum for solvent degassing.	Check the vacuum degasser for an error condition. Refer to the *Service Manual* for the degasser or the pump that has the degasser built-in.

Remote Timeout

Error ID: 0070

A not-ready condition is still present on the remote input. When an analysis is started, the system expects all not-ready conditions (for example, a not-ready condition during detector balance) to switch to run conditions within one minute of starting the analysis. If a not-ready condition is still present on the remote line after one minute the error message is generated.

Probable cause	Suggested actions
1 Not-ready condition in one of the instruments connected to the remote line.	Ensure the instrument showing the not-ready condition is installed correctly, and is set up correctly for analysis.
2 Defective remote cable.	Exchange the remote cable.
3 Defective components in the instrument showing the not-ready condition.	Check the instrument for defects (refer to the instrument's documentation).

Lost CAN Partner

Error ID: 0071

During an analysis, the internal synchronization or communication between one or more of the modules in the system has failed.

The system processors continually monitor the system configuration. If one or more of the modules is no longer recognized as being connected to the system, the error message is generated.

Probable cause	Suggested actions
1 CAN cable disconnected.	• Ensure all the CAN cables are connected correctly. • Ensure all CAN cables are installed correctly.
2 Defective CAN cable.	Exchange the CAN cable.
3 Defective main board in another module.	Switch off the system. Restart the system, and determine which module or modules are not recognized by the system.

Leak Sensor Short

Error ID: 0082

The leak sensor in the module has failed (short circuit).

The current through the leak sensor is dependent on temperature. A leak is detected when solvent cools the leak sensor, causing the leak sensor current to change within defined limits. If the current increases above the upper limit, the error message is generated.

Probable cause	Suggested actions
1 Defective leak sensor.	Please contact your Agilent service representative.
2 Leak sensor incorrectly routed, being pinched by a metal component.	Please contact your Agilent service representative.

Leak Sensor Open

Error ID: 0083

The leak sensor in the module has failed (open circuit).

The current through the leak sensor is dependent on temperature. A leak is detected when solvent cools the leak sensor, causing the leak-sensor current to change within defined limits. If the current falls outside the lower limit, the error message is generated.

Probable cause	Suggested actions
1 Leak sensor not connected to the Power Switch board.	Please contact your Agilent service representative.
2 Defective leak sensor.	Please contact your Agilent service representative.
3 Leak sensor incorrectly routed, being pinched by a metal component.	Please contact your Agilent service representative.

Compensation Sensor Open

Error ID: 0081

The ambient-compensation sensor (NTC) on the power switch board in the module has failed (open circuit).

The resistance across the temperature compensation sensor (NTC) on the power switch board is dependent on ambient temperature. The change in resistance is used by the leak circuit to compensate for ambient temperature changes. If the resistance across the sensor increases above the upper limit, the error message is generated.

Probable cause	Suggested actions
1 Loose connection between the power switch board and the main board	Please contact your Agilent service representative.
2 Defective power switch assembly	Please contact your Agilent service representative.

Compensation Sensor Short

Error ID: 0080

The ambient-compensation sensor (NTC) on the power switch board in the module has failed (open circuit).

The resistance across the temperature compensation sensor (NTC) on the power switch board is dependent on ambient temperature. The change in resistance is used by the leak circuit to compensate for ambient temperature changes. If the resistance across the sensor falls below the lower limit, the error message is generated.

Probable cause	Suggested actions
1 Defective power switch assembly	Please contact your Agilent service representative.
2 Loose connection between the power switch board and the main board	Please contact your Agilent service representative.

Fan Failed

Error ID: 0068

The cooling fan in the module has failed.

The hall sensor on the fan shaft is used by the main board to monitor the fan speed. If the fan speed falls below a certain limit for a certain length of time, the error message is generated.

This limit is given by 2 revolutions/second for longer than 5 seconds.

Depending on the module, assemblies (e.g. the lamp in the detector) are turned off to assure that the module does not overheat inside.

Probable cause	Suggested actions
1 Fan cable disconnected.	Please contact your Agilent service representative.
2 Defective fan.	Please contact your Agilent service representative.
3 Defective main board.	Please contact your Agilent service representative.

Leak

Error ID: 0064

A leak was detected in the module.

The signals from the two temperature sensors (leak sensor and board-mounted temperature-compensation sensor) are used by the leak algorithm to determine whether a leak is present. When a leak occurs, the leak sensor is cooled by the solvent. This changes the resistance of the leak sensor which is sensed by the leak-sensor circuit on the main board.

Probable cause	Suggested actions
1 Loose fittings.	Ensure all fittings are tight.
2 Broken capillary.	Exchange defective capillaries.
3 Leaking rotor seal or needle seat.	Exchange the rotor seal or seat capillary.
4 Defective metering seal.	• Exchange the metering seal. • *Make sure the leak sensor is thoroughly dry before restarting the autosampler.*

Sampler Error Messages

NOTE Please verify the first errors in the list. The last error message could be a subsequent error.

Draw command aborted

Error ID: 25478

The robot (sample handler) failed to move correctly during injection sequence.

Probable cause	Suggested actions
1 Missing vessel	Check if the sample vial is installed in the correct position, or edit the method or sequence accordingly.
2 Needle command failed	Check the status of the needle assembly. Perform an autoreferencing.

Missing vessel

Error ID: 25471

No vial was found in the position defined in the method or sequence. When the needle carrier moves to a vial and the needle lowers into the vial, the position of the needle is monitored by an encoder behind the vial pusher. If no vial is present, the encoder detects an error and the message “missing vial” is generated.

Probable cause	Suggested actions
1 No vial in the position defined in the method	• Install the sample vial in the correct position. • Edit the method or sequence accordingly.
2 Defective needle assembly	Exchange the needle assembly.
3 Defective sample handler	Exchange the sample handler.

Initialization failed

Error ID: 25120

The autosampler failed to complete initialization correctly. The autosampler initialization procedure moves the robot to its reference positions in a predefined routine. During initialization, the processor monitors the position sensors and motor encoders to check for correct movement. During initialization the system also checks the status of the sample hotel and the hydraulic box. If one or more of the movements or the status information of the subparts is not read out successfully, the error message is generated.

Probable cause	Suggested actions
1 Front door not installed correctly.	• Check if the front door is installed correctly. • Check if the magnet is in place in the front door.
2 Sample handler not aligned correctly.	Do an autoreferencing.
3 Mechanical obstruction	Ensure unobstructed movement of the sample handler. Please contact your Agilent service representative.
4 Defective sampling handler motors	Please contact your Agilent service representative.
5 Loose connection between hydraulic box and adapter board	Please contact your Agilent service representative.
6 Defective sample hotel electronic	Please contact your Agilent service representative.
7 Defective specific main board or fusion board	Please contact your Agilent service representative.

8
Test Functions and Calibration

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This chapter describes the built in test functions.

Introduction

All tests are described based on the Agilent Lab Advisor Software B.02.06 or above. Other user interfaces may not provide any test or just a few. For details on the use of the interface refer to the interface documentation.

Table 14 Interfaces and available test functions

Interface	Comment	Available Function
Agilent Lab Advisor	All tests are available	• System Pressure test • Maintenance • Drawer Detection/Auto Referencing
	Adding of pressure to chromatographic signals possible	
Agilent ChemStation	No tests available	• Drawer Detection/Auto Referencing
	Adding of pressure to chromatographic signals possible	• Temperature mainboard • Pressure/Pressure ripple

For details on the use of the interface refer to the interface documentation.

System Pressure Test

The test determines the leak rate of the system between pump outlet valves and a blank nut. The blank nut can be positioned at different locations in the system before the flow cell, to determine and verify the leak rate of individual modules and components. The test allows for setting the pressure at which the test is performed. The leak rate of high pressure parts is not always a linear function and therefore it is recommended to perform the test at a pressure that corresponds to the normal operating pressure of the system.

When

- In case of a suspected leak
- To verify successful execution of maintenance

Parts required

p/n	Description
5067-6127	Blank Nut SL

1 Run the System pressure test with the Agilent Lab Advisor (for further information see Online-Help of user interface).

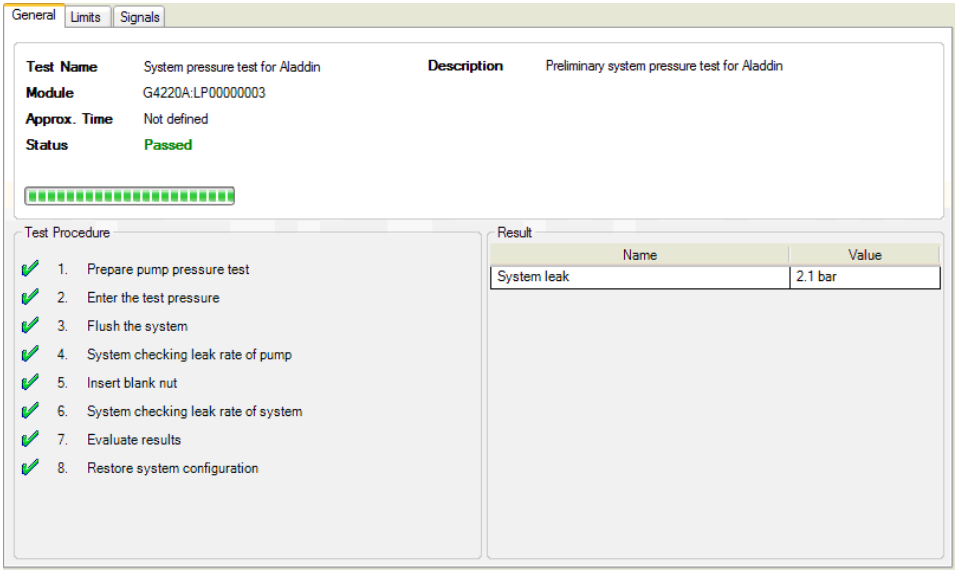


Figure 30 System Pressure Test – Result

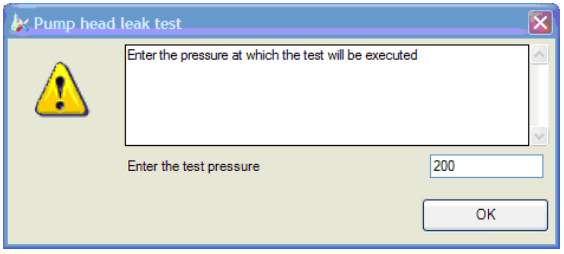


Figure 31 System Pressure Test – Dynamic pressure input

System Pressure Test Evaluation

`Test Failed`

	Probable cause	Suggested actions
1	Damaged blank nut (poorly shaped from over tightening)	Before investigating any other possible sources of failure make sure that the blank nut you are using is in a good condition and properly tightened.
2	Pump leakages	Perform the Pump Head Leak test.
3	Loose or leaky fittings	Tighten the fittings or replace capillaries.
4	Autosampler leakages	Perform the Autosampler Leak test.
5	Themostatted Column Compartment valve leakages	Replace the TCC valve rotor seal.

NOTE Notice the difference between *error* in the test and a *failed* result! An *error* is caused by an abnormal termination during the operation of the test, whereas a *failed* result indicates that the test result were not within the specified limits.

Auto Referencing

The multisampler auto referencing uses predefined positions on the base plate and the sample hotel to calibrate the positioning of the needle parkstation and the sample hotel. The auto referencing is required to compensate deviations in positioning the needle assembly and the sample tray. The auto referencing is required after disassembling the system or when you exchange the sample handler, the sample hotel, the needle parkstation, the needle assembly or one of the main boards. This function is implemented in the drawer detection and in the needle exchange routine.

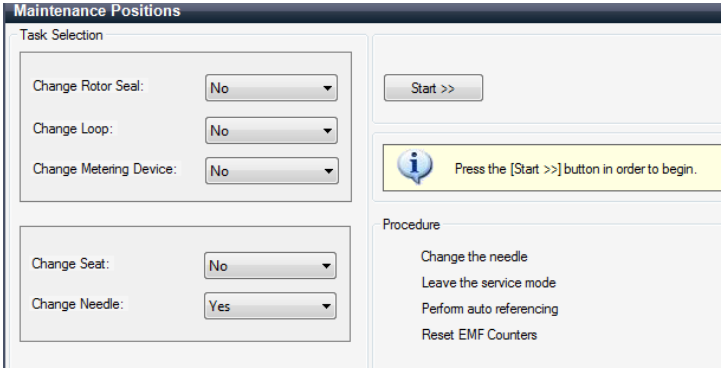
When

After disassembling the module or an exchange of the needle assembly.

Preparations

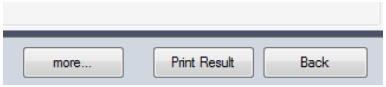
- Workspace of the multisampler is empty
- All drawers are closed properly

1 In the Agilent Lab Advisor software select **Service & Diagnostics** in the system screen **Maintenance Positions > Change Needle**, select **YES** click **Start** and wait until the needle assembly is in maintenance position.



2 If no needle assemby have to be changed click **Next**. The Agilent Lab Advisor software will perform an auto referencing and reset the EMF counters.

3 Click the **Back** button to leave the **Service & Diagnosis** menu.



NOTE For auto referencing, you can alternatively use the drawer configuration.

Maintenance Positions

Some maintenance procedures require the needle assembly, the sample loop flex, the metering device and the needle seat to be moved to specific positions to enable easy access to components. The maintenance functions move these assemblies into the appropriate maintenance position. In the Agilent Lab Advisor Software the maintenance positions can be selected in the **Service & Diagnostics** view.

When Performing maintenance on the module

1 Run the Maintenance Positions in the **Service & Diagnostics** View in the Agilent Lab Advisor (for further information see Online-Help of user interface).

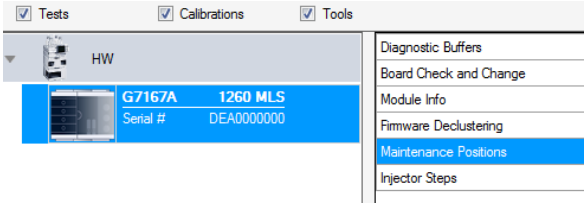


Figure 32 Maintenance Positions

Change Needle Assembly

The Sample handler is positioning the needle assembly so that there is easy access for changing needle assembly or needle seat. The position is far to the left of the needle parkstation, and the current to the motors are off, so that the Z-drive of the robot can be moved while servicing the module.

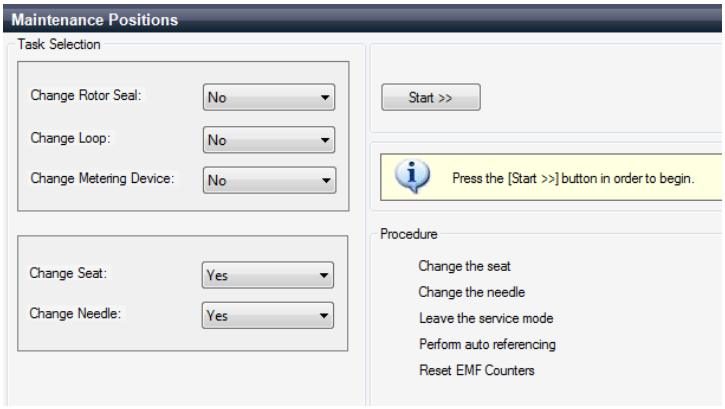


Figure 33 Change Needle Asssembly

Change Sample Loop Capillary

The **Change Loop** command positions the Z-drive of the robotarm far to the left of the needle parkstation to enable easy exchange of the sample loop cartridge.

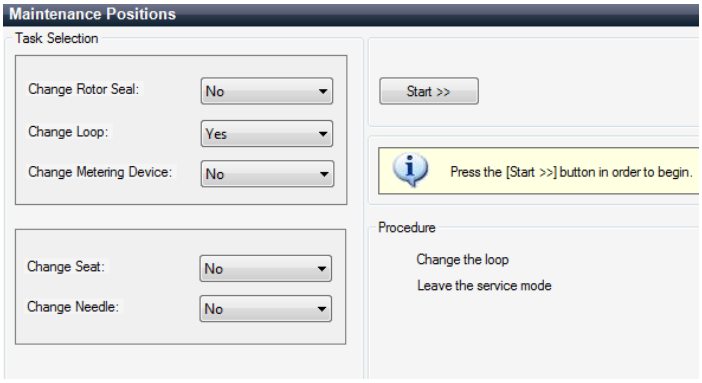


Figure 34 Change Sample Loop Capillary

Arm Position

The home position of the multisampler ensures a better access to the workspace. When transporting the module it is highly recommended to use the **Instrument Control > Park Position** command, in order to place the Sample Handler in a position for safe transport.

Figure 35 Park Position Button

NOTE If the transport assembly is not parked and not protected by the transport foam, the module could be damaged due to excessive shock of the shipping container during transport.

Change Metering Device

When removing the metering device is necessary (by exchanging the metering seal for instance), the metering drive needs to be moved to a position at the far back, in order to prevent seal and/or piston damage.

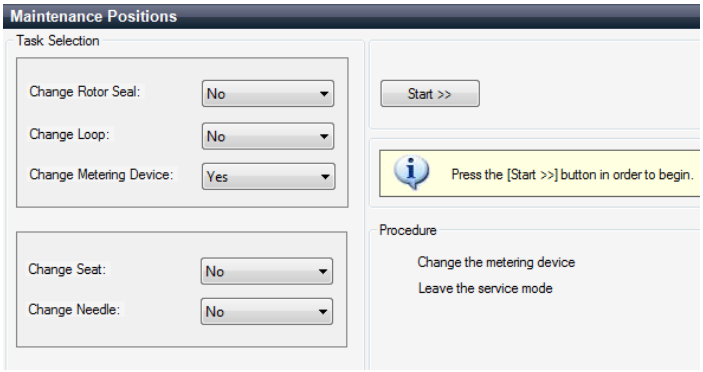
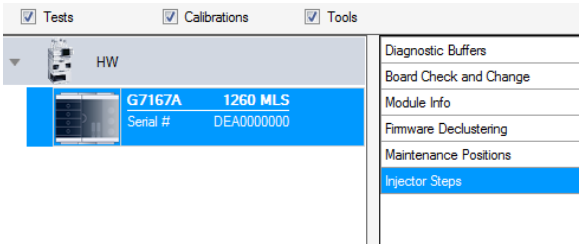


Figure 36 Change Metering Device

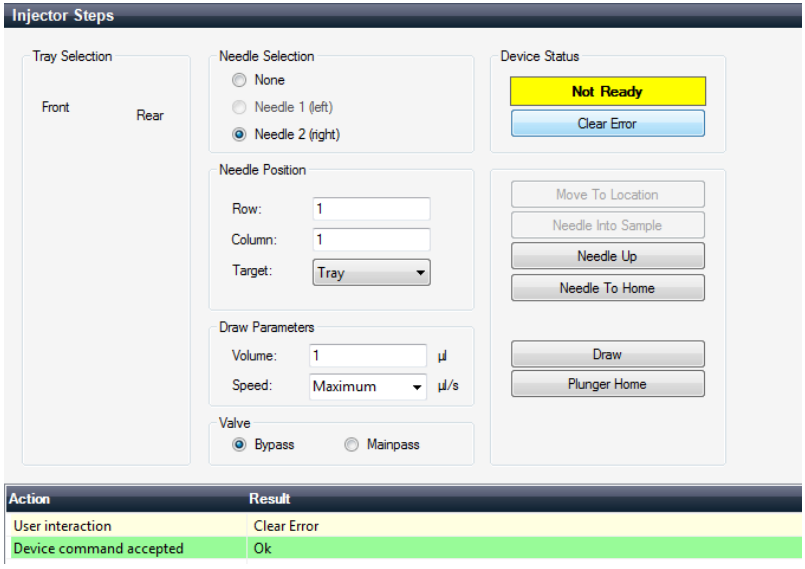
Injector Steps

Each movement of the sampling sequence can be done under manual control. This is useful during troubleshooting, where close observation of each of the sampling steps is required to confirm a specific failure mode or verify successful completion of a repair. Each injector step command actually consists of a series of individual commands that move the multisampler components to predefined positions, enabling the specific step to be done.

1 Run the **Injector Steps** in the **Service & Diagnostics** View in the Agilent Lab Advisor (for further information see Online-Help of user interface).



2 Select the individual step command like needle selection and needle position (for further information see Online-Help of user interface).



9 Maintenance

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This chapter describes the maintenance of the Multisampler

Introduction to Maintenance

Figure 37 on page 146 shows the main user accessible assemblies of the multisampler. These parts can be accessed from the front (simple repairs) and don't require to remove the multisampler from the system stack.

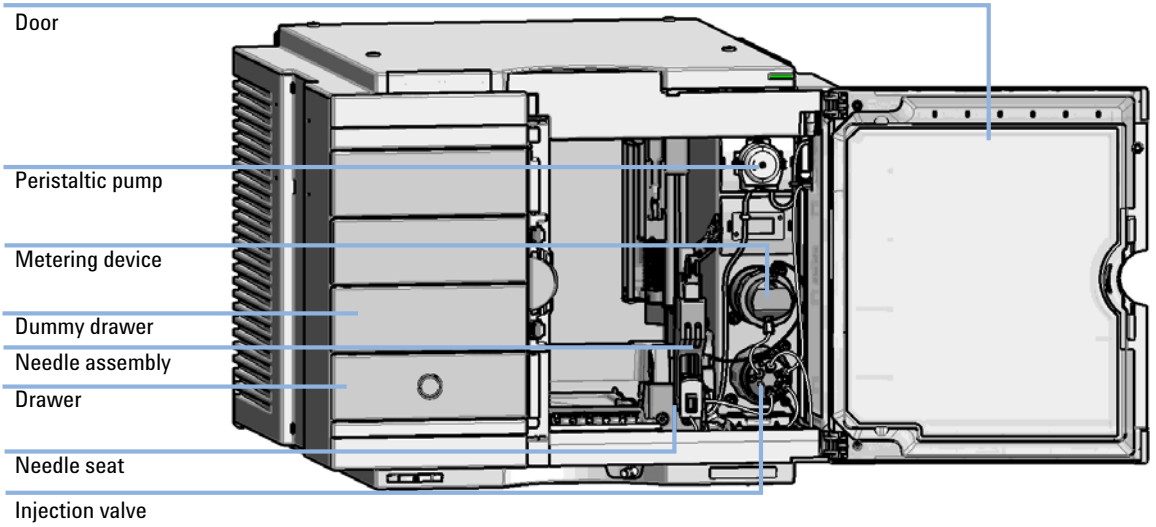


Figure 37 Main user accessible assemblies (standard)

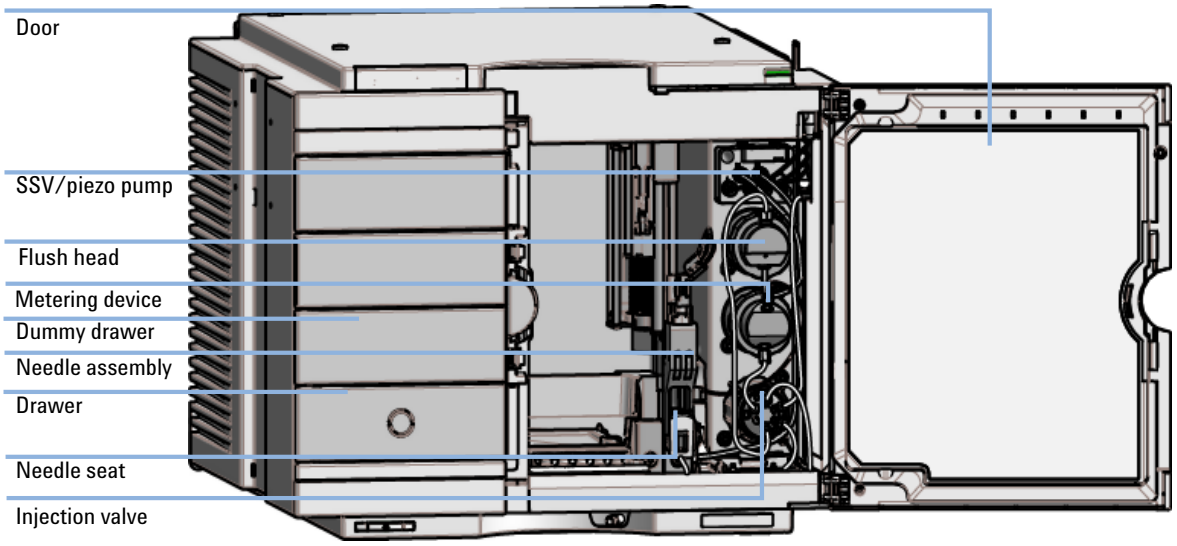


Figure 38 Main user accessible assemblies (multiwash)

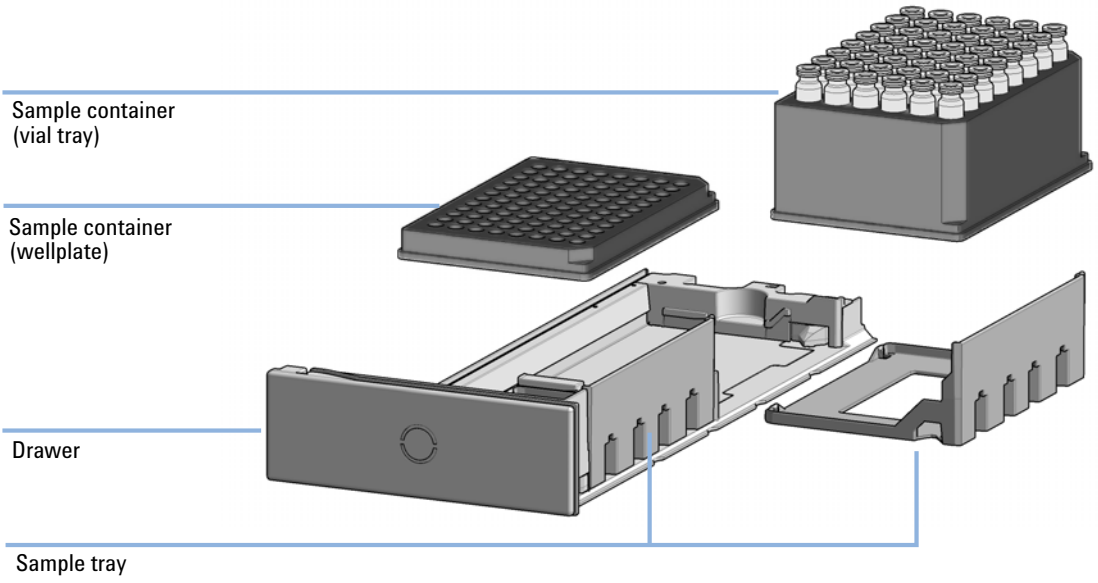


Figure 39 Overview of drawer, sample tray and sample container

Warnings and Cautions

WARNING

Personal injury or damage to the product

Agilent is not responsible for any damages caused, in whole or in part, by improper use of the products, unauthorized alterations, adjustments or modifications to the products, failure to comply with procedures in Agilent product user guides, or use of the products in violation of applicable laws, rules or regulations.

➔ Use your Agilent products only in the manner described in the Agilent product user guides.

WARNING

Electrical shock

Repair work at the module can lead to personal injuries, e.g. shock hazard, when the cover is opened.

➔ Do not remove the cover of the module.

➔ Only certified persons are authorized to carry out repairs inside the module.

WARNING

Sharp metal edges

Sharp-edged parts of the equipment may cause injuries.

➔ To prevent personal injury, be careful when getting in contact with sharp metal areas.

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

The handling of solvents, samples and reagents can hold health and safety risks.

➔ When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.

➔ The volume of substances should be reduced to the minimum required for the analysis.

➔ Do not operate the instrument in an explosive atmosphere.

CAUTION

Safety standards for external equipment

➔ If you connect external equipment to the instrument, make sure that you only use accessory units tested and approved according to the safety standards appropriate for the type of external equipment.

Overview of Maintenance

It is necessary to perform periodic inspection of this instrument to ensure its safe use. It is possible to have these periodic inspections performed by Agilent service representatives on a contractual basis. For information regarding the maintenance inspection contract, contact your Agilent representative.

The following pages describe the maintenance (simple repairs) of the module that can be carried out without opening the main cover.

Table 15 Overview of maintenance

Procedure	Typical interval (minimum)	Notes
Change needle/needle seat	60000 needle into seat	
Change peristaltic pump cartridge	3000 min on time	
Change rotor seal	30000 injections	

Clean the Module

To keep the module case clean, use a soft cloth slightly dampened with water, or a solution of water and mild detergent.

WARNING **Liquid dripping into the electronic compartment of your module can cause shock hazard and damage the module**

➔ Do not use an excessively damp cloth during cleaning.

➔ Drain all solvent lines before opening any connections in the flow path.

Removal and Installation of the Front Door

When	If the front door is defective or the hinge are damaged.	
Tools required	**Description**	
	Flat screwdriver	
Parts required	**p/n**	**Description**
	5067-5415	Door Assy
Preparations	Finish any pending acquisition job and return any plate on the workspace back to the hotel.	

NOTE For detailed information on position of the magnets, refer to "Magnets" on page 48

CAUTION

Magnetic fields

Magnets produce a far-reaching, strong magnetic field.

You can damage for example televisions, laptops, computer harddisks, credit cards, magnetic cards may be damaged as well.

➔ Keep magnets at least 25 mm away from devices and objects that could be damaged by strong magnetic fields.

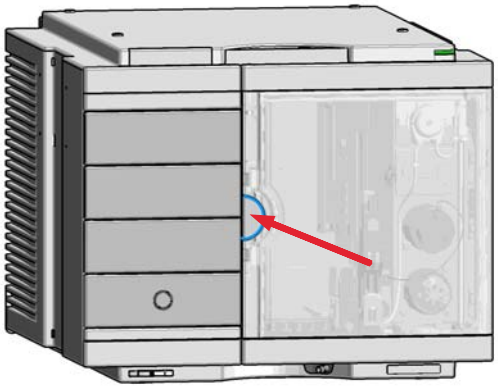
WARNING

Heart pacemakers

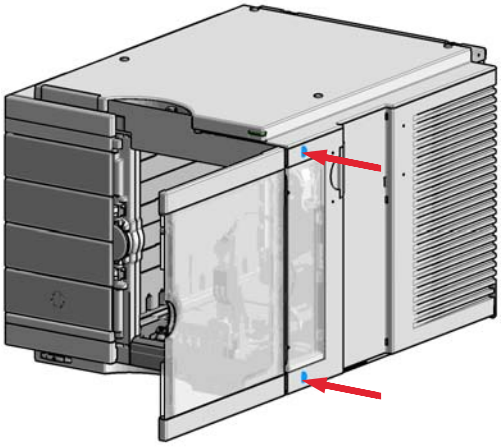
Magnets may derogate the function of heart pacemakers and implanted defibrillators. Heart pacemakers may switch to the test modus which may cause malaise. Defibrillators may malfunction.

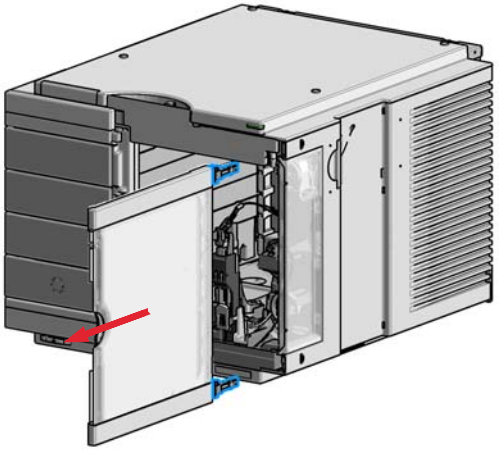
➔ Bearers of heart pacemakers or implanted defibrillators must stay off at least 55 mm from the magnets.

1 Open the front door.

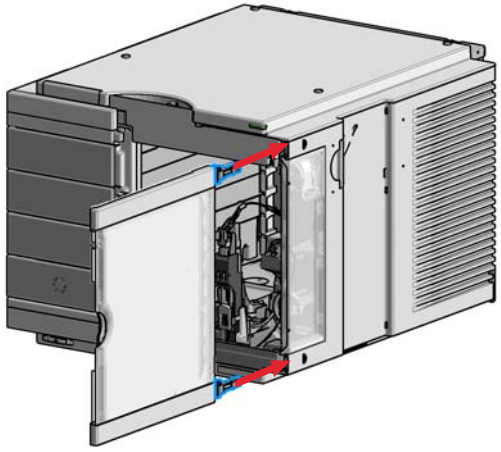


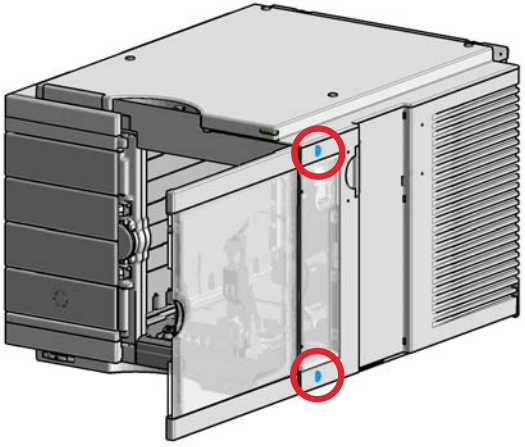
2 Press the release buttons and pull the front door out.





3 For the Installation of the front door. Insert the hinges into their guides and move the door in until the release buttons click into their final position.





Remove the Needle Assembly

When

When the limit in the needle into seat counter in the EMF is exceeded or when needle shows indications of damage, blockage or leaks.

Tools required

p/n	Description
8710-0510	Wrench open 1/4 — 5/16 inch

Parts required

	#	p/n	Description
	1	G4267-87201	Needle Assembly
OR	1	G4267-87210	Needle Assembly (slotted) for high injection volumes

Preparations

In order to avoid leaks, stop the pump running and remove the tubings from the solvent bottles. If available close the shutoff valves.

WARNING

Risk of injury by uncovered needle

An uncovered needle is a risk of harm to the operator.

➔ Do not open the safety lock of the needle assembly

➔ Be careful working at the z-robot.

➔ Wear safety goggles, when removing the needle assembly.

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

The handling of solvents, samples and reagents can hold health and safety risks.

➔ When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.

NOTE

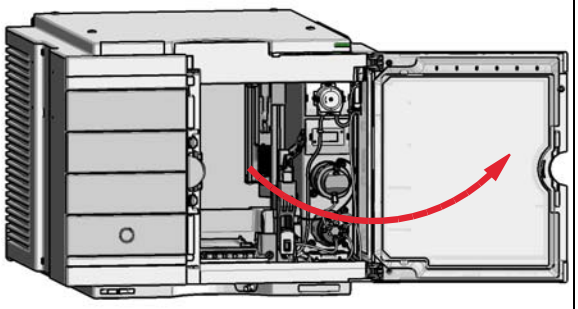
It is recommended to always exchange the needle assembly and the needle seat at the same time to prevent premature leakage.

1 In the Instant Pilot start the maintenance mode and select **Change needle/seat** function.

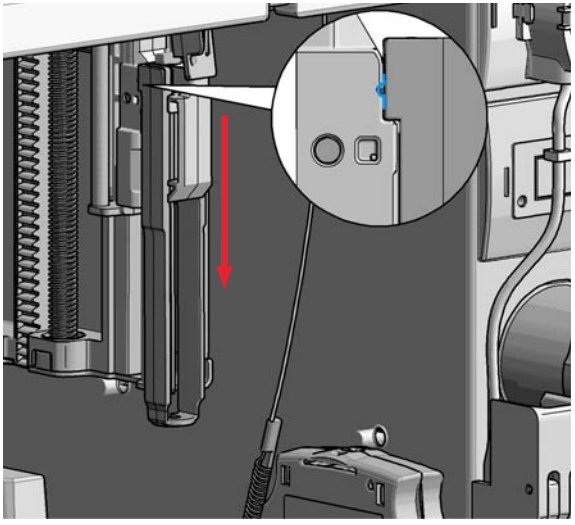
OR

In the Agilent Lab Advisor software select **Service & Diagnostics** in the system screen (**Tools**) **Maintenance Positions > Change Needle/Loop**, click **Start** and wait until the needle assembly is in maintenance position.

2 Open the front door.



3 Lock the needle in the safety position.

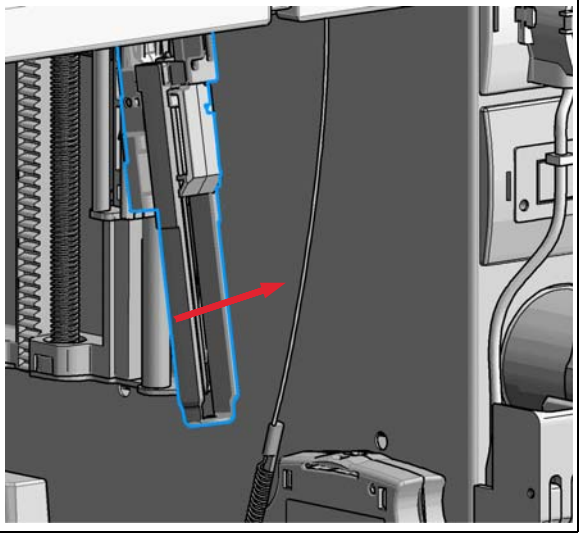


WARNING

Sharp needle
Uncovered needles may cause injuries

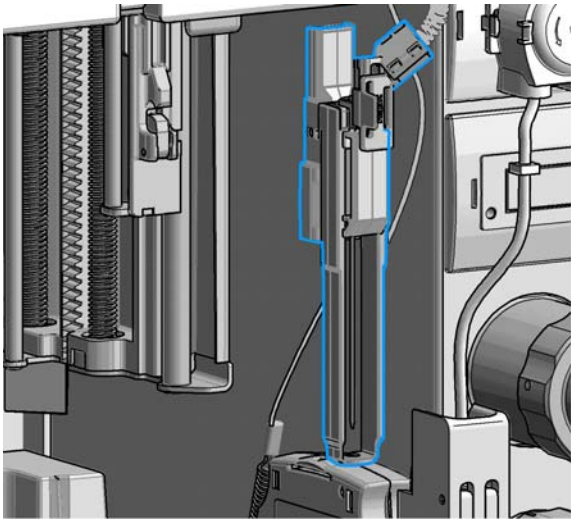
➔ **Make sure the needle is in the safety lock position.**

4 Remove the needle assembly by slightly pulling the needle cartridge.



5

Z-Robot (Z-arm coupler) without the needle assembly.



CAUTION

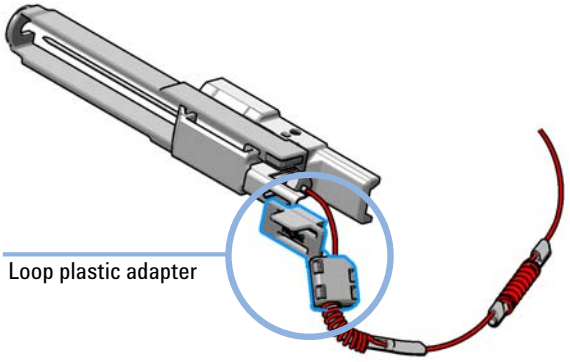
Damage of the loop

The loop shape may be damaged if the loop is stretched or bent too far.

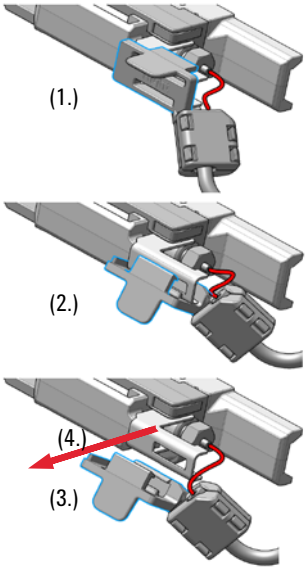
→ **Avoid to change the loop shape.**

→ **Do not pull or bend the loop too far.**

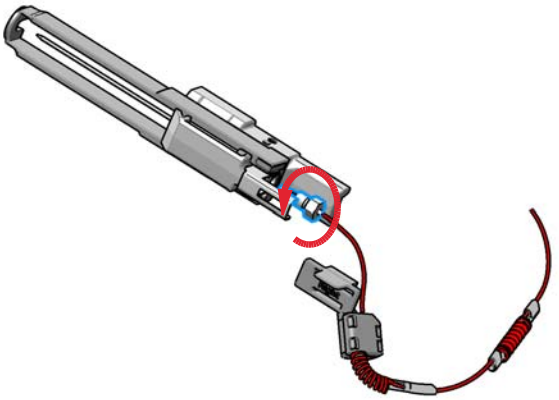
6 The needle assembly is still connected to the loop capillary.

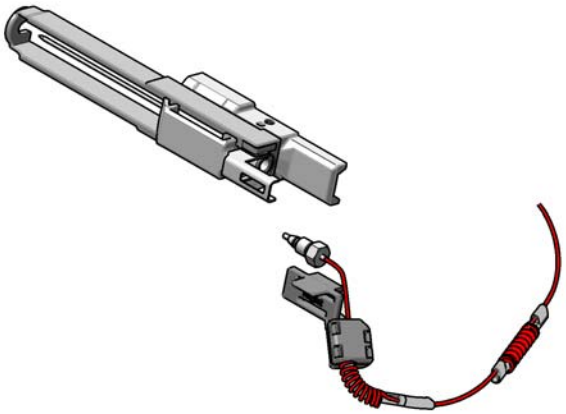


7 Remove the loop plastic adapter.



8 Use a 1/4 inch wrench to loosen the fitting of the loop capillary.



9 Remove the needle assembly. 	

Install the Needle Assembly

When

When the limit in the needle into seat counter in the EMF is exceeded or when needle shows indications of damage, blockage or leaks.

Tools required

p/n	Description
8710-0510	Wrench open 1/4 — 5/16 inch

Parts required

	#	p/n	Description
	1	G4267-87201	Needle Assembly
OR	1	G4267-87210	Needle Assembly (slotted) for high injection volumes

Preparations

In order to avoid leaks, stop the pump running and remove the tubings from the solvent bottles. If available close the shutoff valves.

WARNING

Risk of injury by uncovered needle

An uncovered needle is a risk of harm to the operator.

➔ Do not open the safety lock of the needle assembly

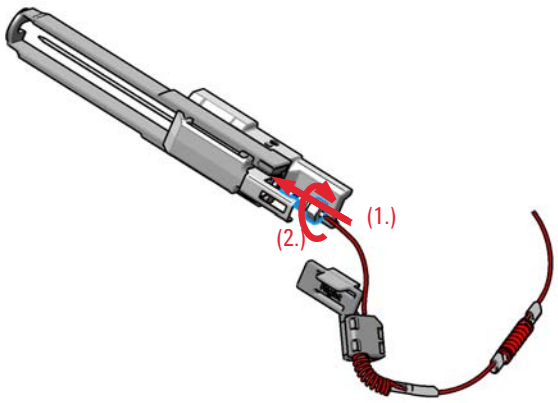
➔ Be careful working at the z-robot.

➔ Wear safety goggles, when removing the needle assembly.

NOTE

It is recommended to always exchange the needle assembly and the needle seat at the same time to prevent premature leakage.

1 Install the loop capillary on top of the needle cartridge (1.) and tighten the fitting hand tight (2.).



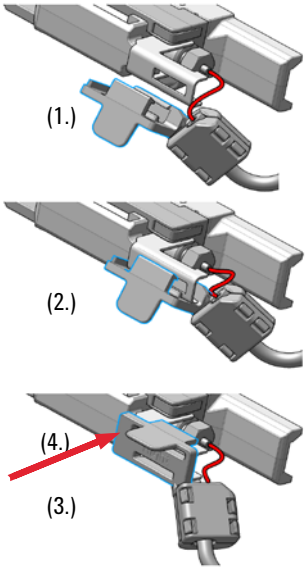
CAUTION

Blockages

➔ **Do not overtighten the fitting. A quarter turn should be sufficient.**

2 Use a 1/4 inch wrench to tighten the fitting of the loop capillary.

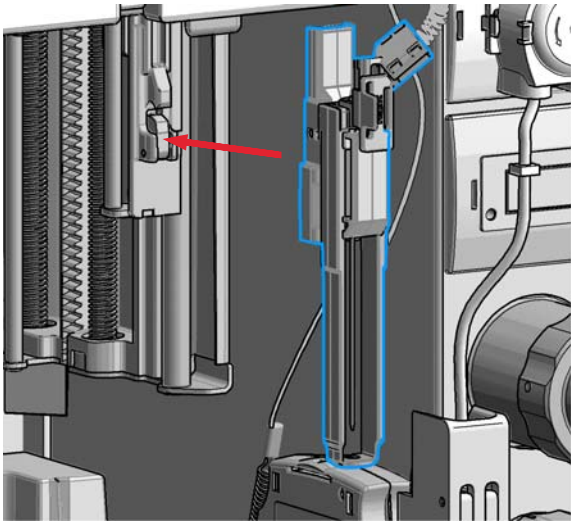
3 Install loop plastic adapter.

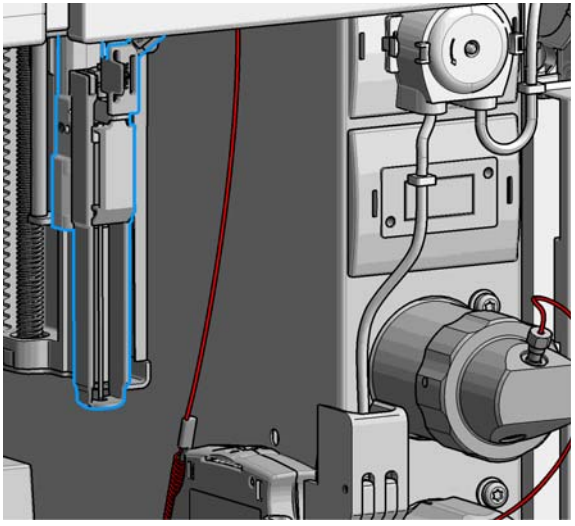


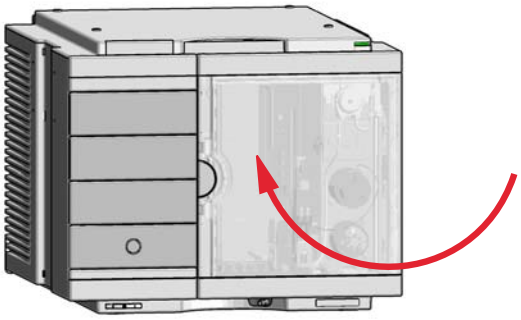
4 Pinch and reinsert the needle assembly and the connected loop capillary into the z-arm coupler.

NOTE

Check the tension of the loop capillary. This must be forced and guided to the hydraulic box to prevent it from being caught by the Z-drive.





5 Close the front door. 	In the Instant Pilot close **Change needle /seat**. OR In the Agilent Lab Advisor software **Change needle/loop > End**, click **End** and wait until the needle assembly is in the needle park station. **6** Perform a pressure test.

Exchange the Needle Seat

When When seat is visibly damaged, blocked or leaks.

Tools required

p/n	Description
8710-0510	Wrench open 1/4 — 5/16 inch
	Flat head screwdriver

Parts required

	#	p/n	Description
	1	G4267-87012	High Pressure Needle Seat, 0.12 mm (PEEK)
OR	1	G4267-87020	High Pressure Seat Assembly 0.075 mm (PEEK)

Preparations In order to avoid leaks, stop the pump running and remove the tubings from the solvent bottles. If available close the shutoff valves.

WARNING

Risk of injury by uncovered needle

An uncovered needle is a risk of harm to the operator.

- ➔ Do not open the safety lock of the needle assembly
- ➔ Be careful working at the z-robot.
- ➔ Wear safety goggles, when removing the needle assembly.

NOTE

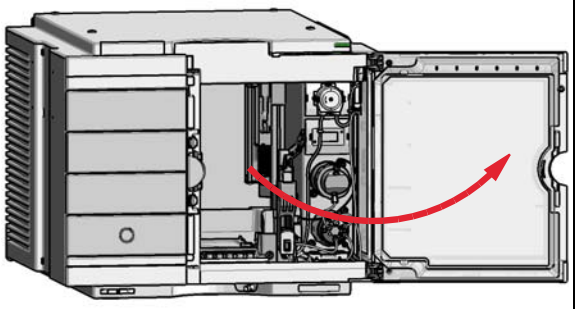
Refer the Agilent 1290 Infinity II Ultra Low Dispersion Kit Technical Note (p/n 01200-90105) for further details.

1 In the Instant Pilot start the maintenance mode and select **Change needle/seat** function.

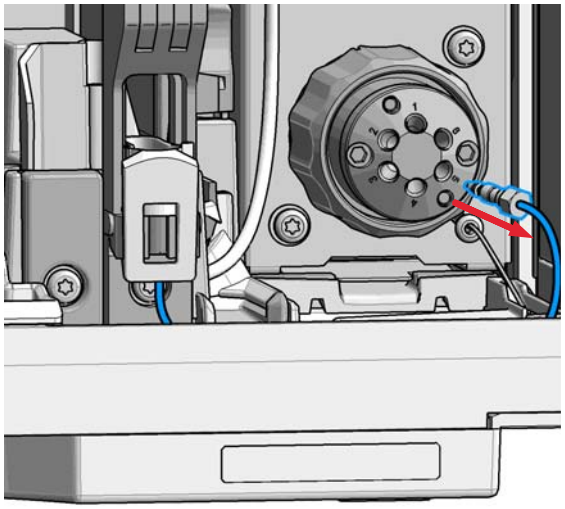
OR

In the Agilent Lab Advisor software select **Service & Diagnostics** in the system screen **Maintenance Positions > Change Needle**, click **Start** and wait until the needle assembly is in maintenance position.

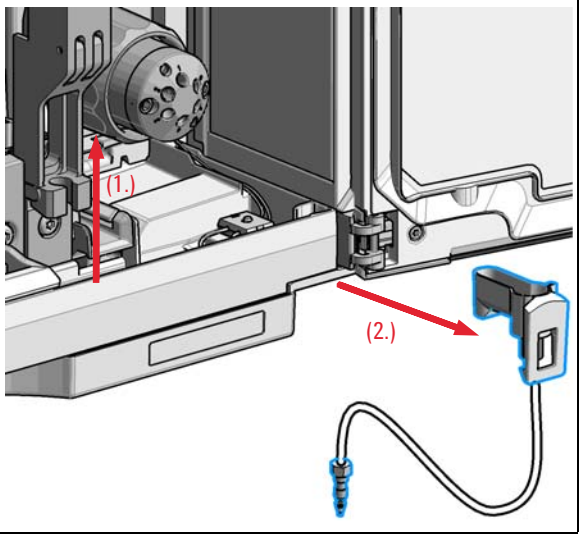
2 Open the front door.



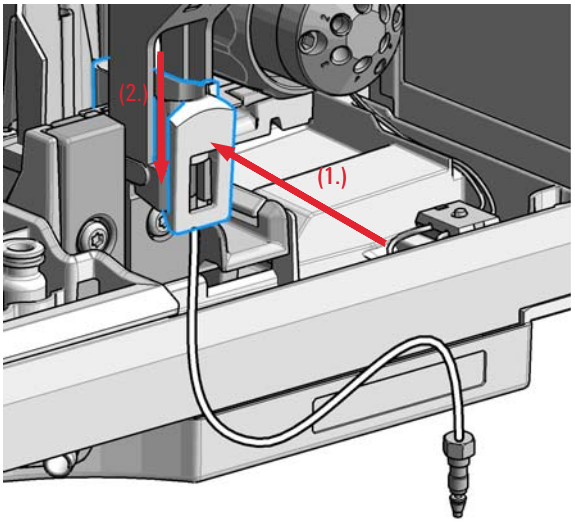
3 Disconnect the seat capillary from the Injection valve.



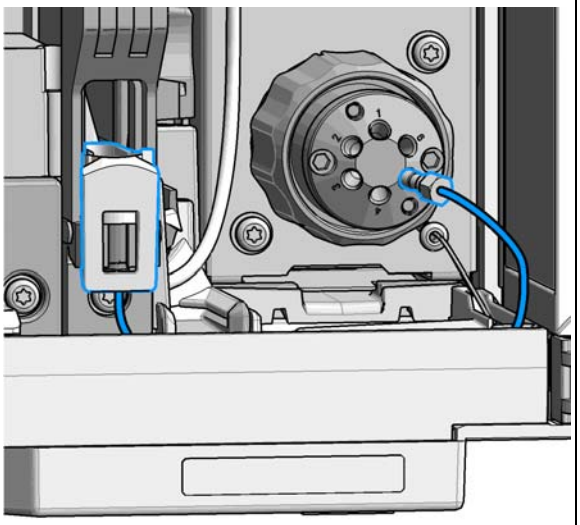
4 With a flat head screw driver carefully lift out the needle seat (1.). Then remove the complete leak tube needle seat assembly from the holder (2.).



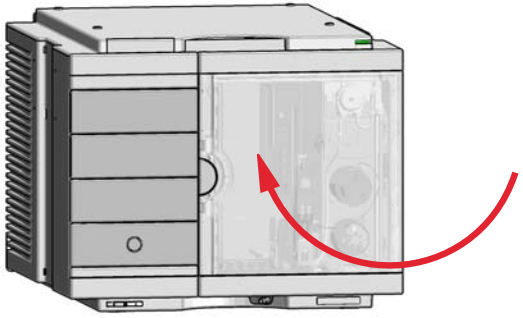
5 Insert the new Needle seat (1.). Press it firmly in position (2.).



6 Reconnect the seat capillary to the injection valve.



7 Close the front door.



In the Instant Pilot close **Change needle /seat**.

OR

In the Agilent Lab Advisor software **Change needle** click **End** and wait until the needle assembly is in the needle park position.

8 Perform a pressure test.

Replace the Rotor Seal

When When poor injection volume reproducibility or when injection valve is leaking.

Tools required

p/n	Description
8710-0510	Wrench open 1/4 — 5/16 inch
8710-2394	Hex key 9/64 inch 15 cm long T-handle
	Cleaning tissue and appropriate solvent like isopropanol or methanol

Parts required

#	p/n	Description
1	5068-0198	Rotor Seal 1300 bar (PEEK) for 1290 Infinity II Injection Valve
1	5068-0209	Rotor Seal 600 bar (PEEK) for 1260 Infinity Injection Valve
1	5068-0229	Rotor Seal for 3Pos/6Port Peripheral Valve Dual Needle
1	5068-0232	Rotor Seal for 2Pos/8Port Injection Valve Dual Needle

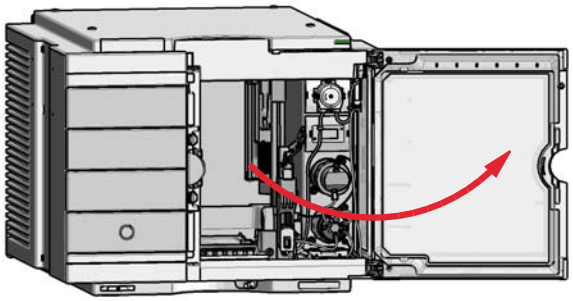
CAUTION Reduced life time of the injection valve

Component cleanliness is crucial for the life time of the injection valve.

➔ Replace the rotor seal in a clean environment.

NOTE Please bear in mind that depending on which valve you have installed the images may slightly differ from the actual item.

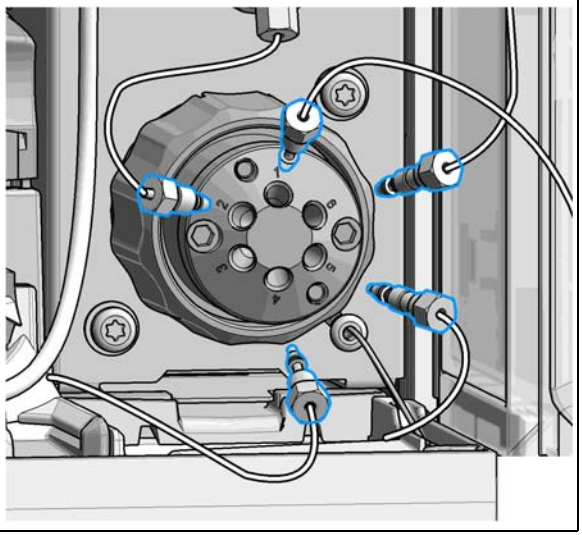
1 Open the front door.



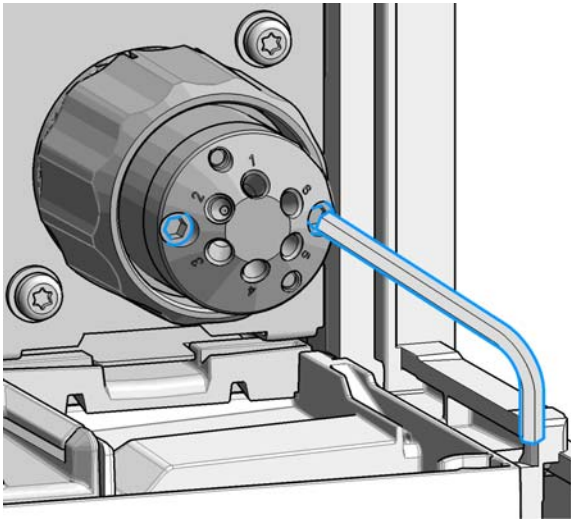
2 Remove all capillaries from the injection valve with a 1/4 inch wrench.

NOTE

Remember the correct plumbing.



3 Use a 9/64 inch hex driver to unscrew the two socket screws which hold the stator head in place.



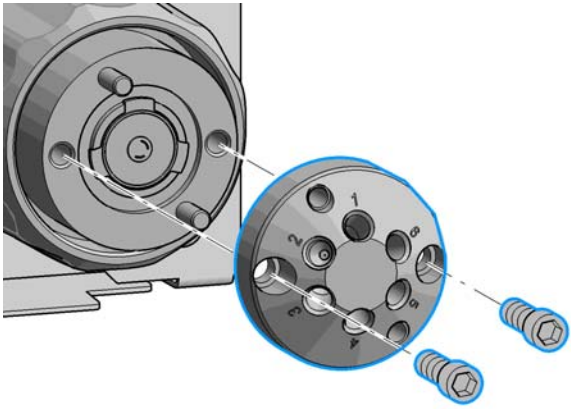
CAUTION

Damage to the stator head
The polished sealing surface of the stator head contains six ports that access handling can easily damage.

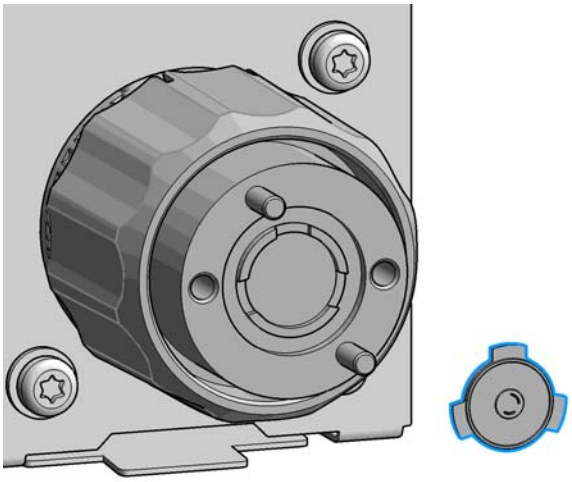
➔ **Avoid touching the polished surface of the stator head.**

➔ **Never place the polished surface on a hard surface.**

4 Carefully remove the stator head. To ensure that the sealing surface of the stator head is not damaged, place it on its outer face.



5 Remove the rotor seal.



NOTE

Remove the rotor seal with a small tool, gently pry the rotor seal away from the drive.

Examine the rotor sealing surface for scratches and nicks.

- If scratches are visible the rotor seal must be replaced.
- If no scratches are visible clean all the parts with an appropriate solvent, taking care that no surfaces get scratched.

CAUTION

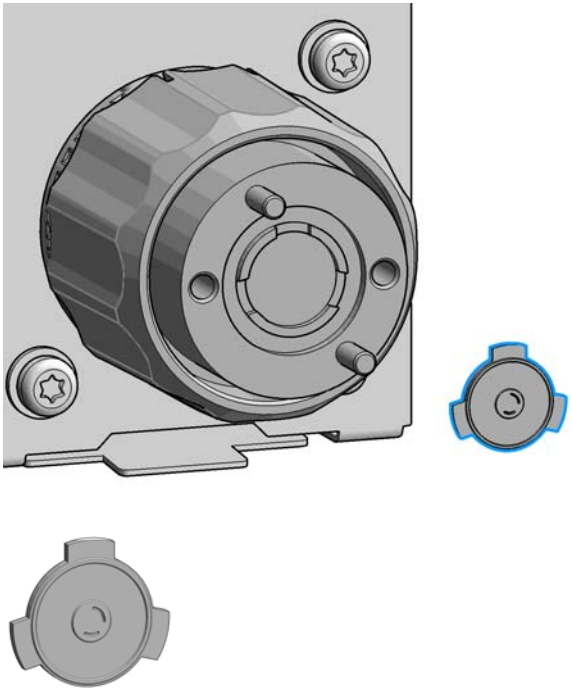
Damage to the rotor seal and cross-port leaks

→ Before you replace the rotor seal, clean the stator.

→ Inspect the stator head and swab it with the appropriate solvent. If more stringent cleaning is required, use a sonicator. Inspect the remaining valve components for contamination. Clean them as necessary.

→ If the stator head is scratched, replace the valve.

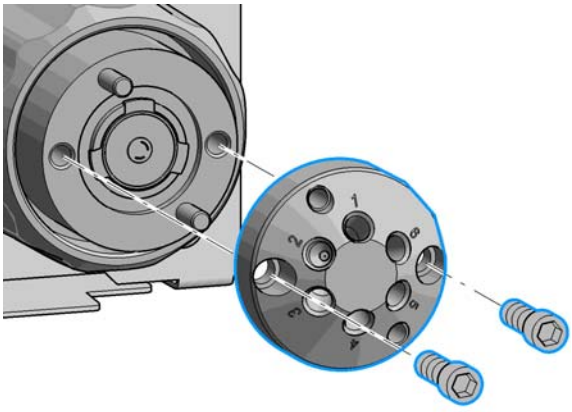
6 Install new rotor seal.



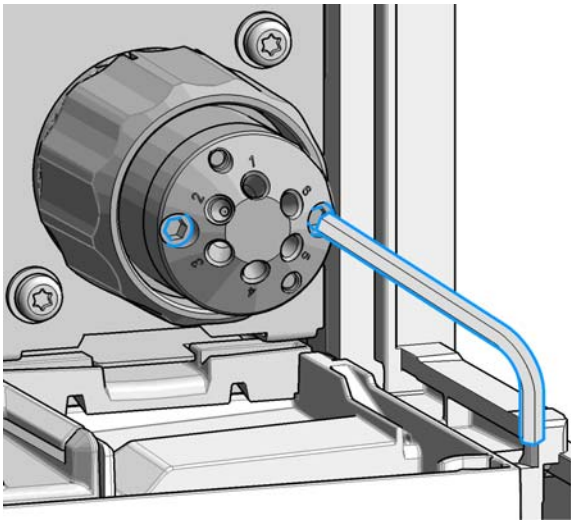
NOTE

Make sure that the rotor sealing surface with its engraved flow passages is facing out. The pattern is asymmetrical to prevent improper placement.

7 Reinstall the stator head. The index pins on the drive and the stator head must engage in the corresponding holes. Insert the two socket head screws.



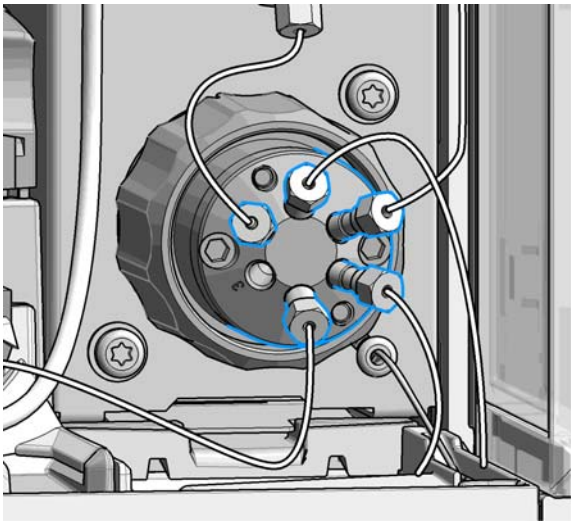
8 Using a 9/64 in. L-Hex wrench, tighten each screw gently until you feel resistance (approximately fingertight). Tighten each screw by 1/8 turn, and then tighten each screw again, until the stator is secured to the driver.



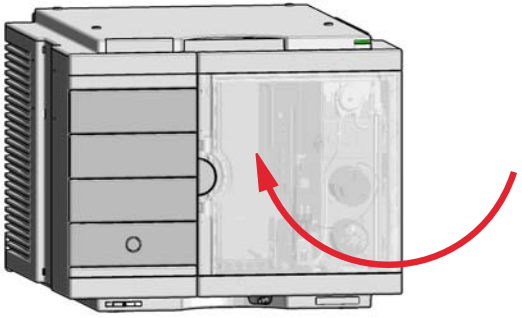
NOTE

Do not over-tighten the screws. The screws hold the assembly together and do not affect the sealing force. The sealing force is automatically set as the screws close the stator head against the valve body.

9 Reconnect all capillaries to the proper injection valve ports with a 1/4 inch wrench



10 Close the front door.



11 Perform a pressure test.

Remove the Metering Seal

When When poor injection volume reproducibility or when metering device / analytical head is leaking.

Tools required	**p/n**	**Description**
	8710-0510	Wrench open 1/4 — 5/16 inch
	8710-2392	4 mm Hex key
	01018-23702	Insert tool
OR	G4226-43800	Seal insert tool for 100 µL or 40 µL

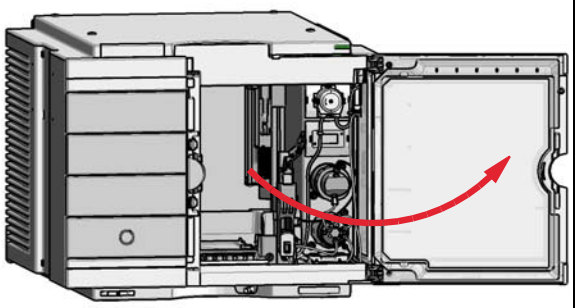
Parts required	**#**	**p/n**	**Description**
	1	0905-1717	Metering seal 40 µL for 40 µL analytical head
	1	0905-1719	Metering seal 100 µL for 100 µL analytical head
	1	5067-5620	Piston ceramic 40 µL If previous piston is scratched
	1	5067-5678	Piston ceramic 100 µL If previous piston is scratched

1 In the Instant Pilot start the maintenance mode and select **Change metering device** function.

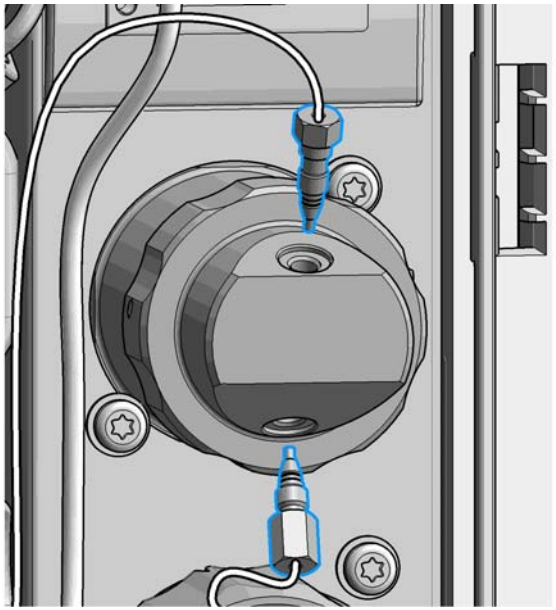
OR

In the Agilent Lab Advisor software select **Service & Diagnostics** in the system screen **(Tools) > Maintenance Positions > Change Metering Device**, click start and wait until the metering device is in maintenance position.

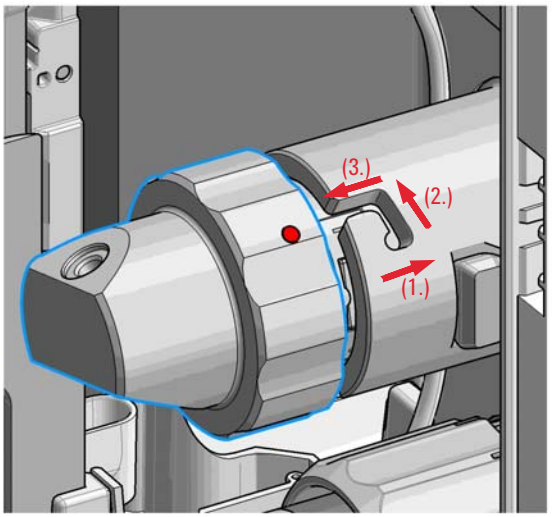
2 Open the front door.



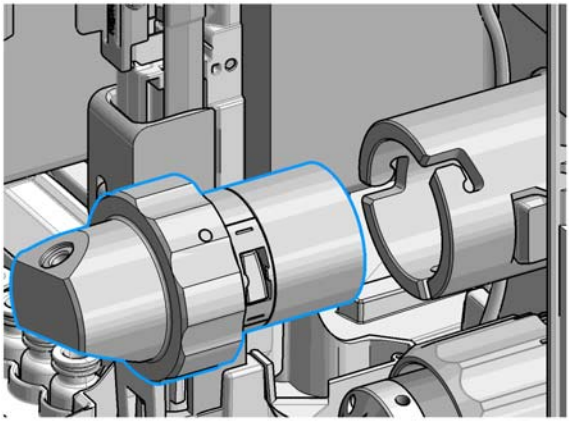
3 Disconnect all capillaries from the metering device.



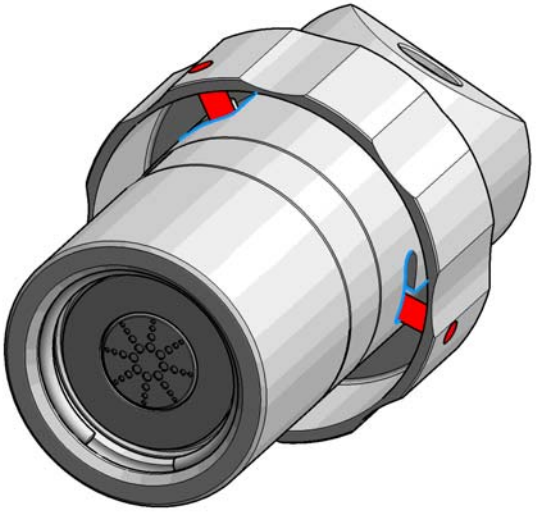
4 To release the bayonet lock, push (1.) and rotate (2.) the analytical head a quarter left. Then you can pull and detach the analytical head assembly from the actuator (3.).

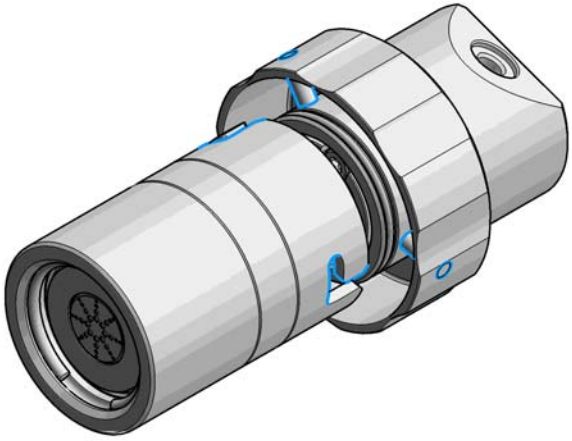
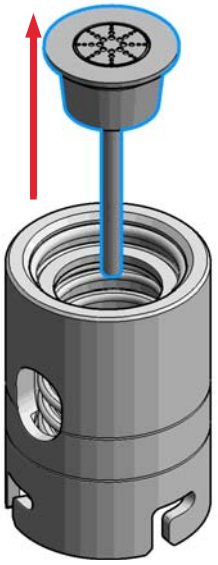


5 Remove the metering device.

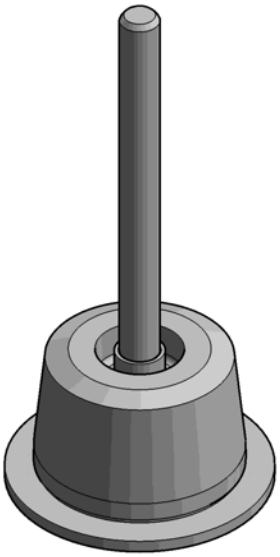


6 Take the metering device. Push against the rear side of the metering device and rotate a quarter left to release the bayonet lock.



7 Now you can separate the analytical head and head body. 	**8** Remove the piston out of the head body. 

9 Inspect the piston for cleanliness and scratches.

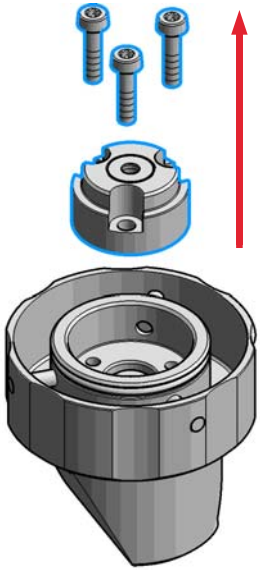


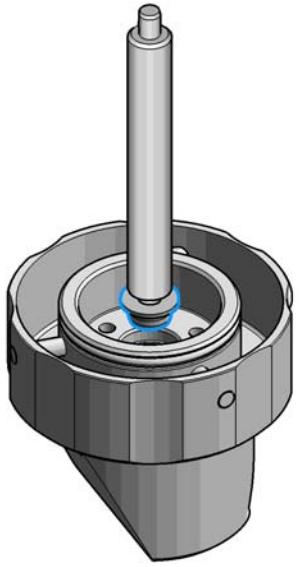
- If dirty:

  Clean the piston with an appropriate solvent.
- If scratched:

  Replace the piston by a new one.

10 Take the analytical head and remove the three screws on the rear side, which holds the support ring in place. Check the support ring for any damages.



11 Carefully remove the metering seal using the steel side of the insert tool. Clean the chamber with an appropriate solvent and ensure that all particulate matter is removed. 	

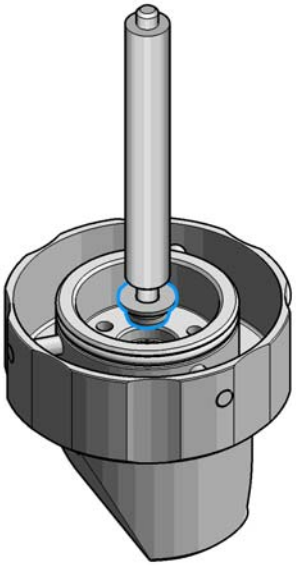
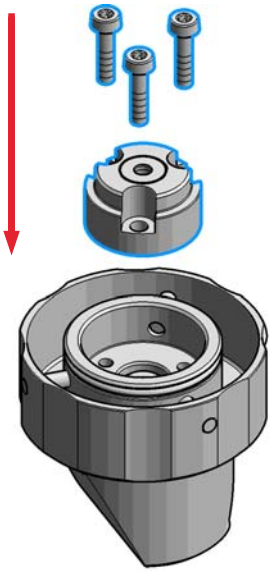
Install the Metering Seal

When After removing the metering seal.

Tools required	**p/n**	**Description**
	8710-0510	Wrench open 1/4 — 5/16 inch
	8710-2392	4 mm Hex key
	01018-23702	Insert tool
OR	G4226-43800	Seal insert tool for 100 µL or 40 µL
		Cleaning tissue and appropriate solvent like isopropanol or methanol

Parts required	**#**	**p/n**	**Description**
	1	0905-1717	Metering seal 40 µL for 40 µL analytical head
	1	0905-1719	Metering seal 100 µL for 100 µL analytical head
	1	5067-5620	Piston ceramic 40 µL If previous piston is scratched
	1	5067-5678	Piston ceramic 100 µL If previous piston is scratched

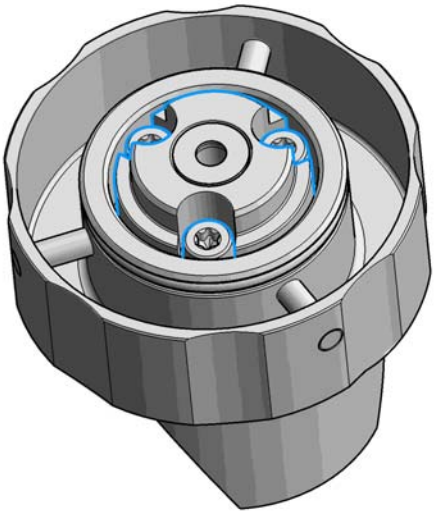
Preparations Removing the metering seal, see "Remove the Metering Seal" on page 173

1 Install the new metering seal using the plastic side of the insert tool. Press it firmly into position. Avoid any offset angle as it might deform the seal. 	**2** Reassemble the support ring. 

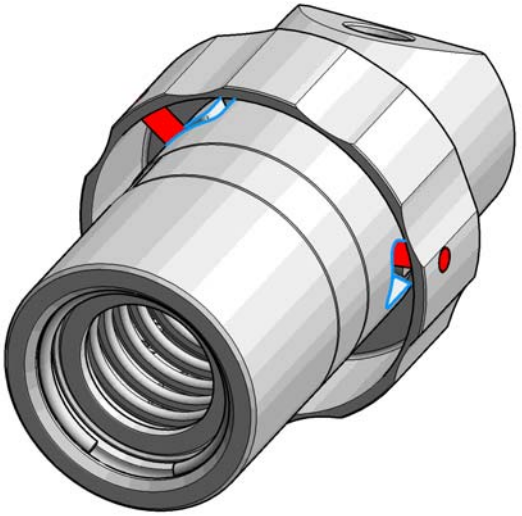
3 Make sure to comply to the following order of actions:

a Tighten the three screws fingerthight, then

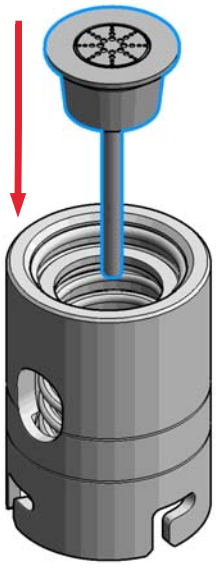
b Tighten the screws a little at a time to keep the support ring surface *parallel* (important!) to the surface of the analytical head.



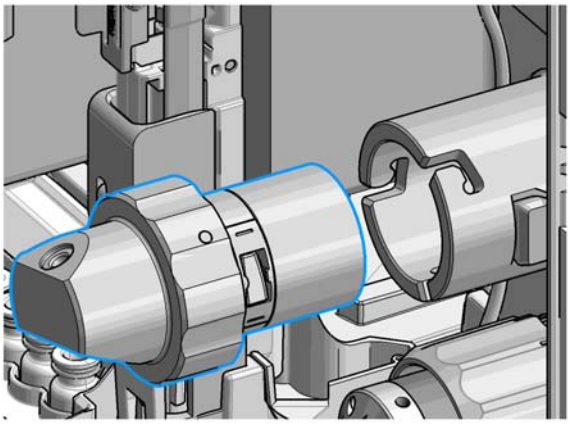
4 Use the twist and lock bayonet mechanims to reassemble the analytical head assembly. Push the two parts together to couple the head body with the analytical head. Once the pin reaches the bottom of the slot, one or both parts are rotated so that the pin slides along the horizontal arm of the L until it reaches the *serif*. The spring then pushes the male connector up into the *serif* to keep the pin locked into place.



5 Press the piston carefully into the housing of the head body and the seal.



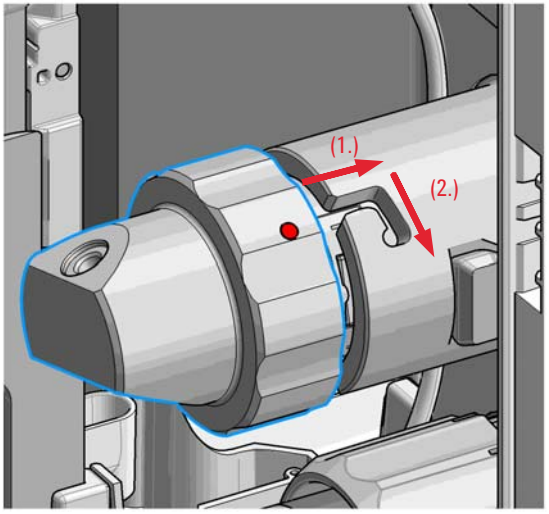
6 Reinstall the complete analytical head with the actuator housing

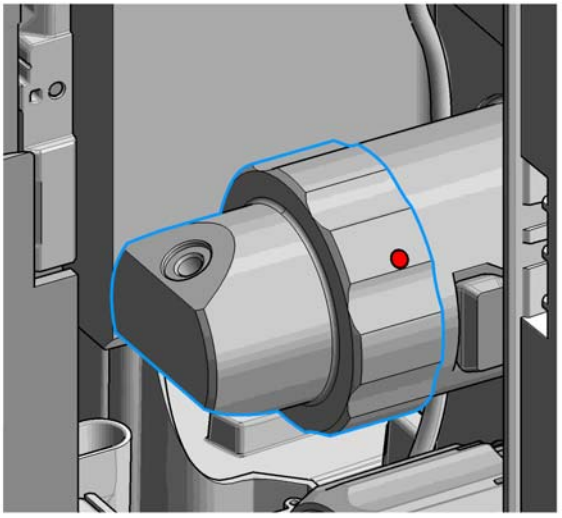


NOTE

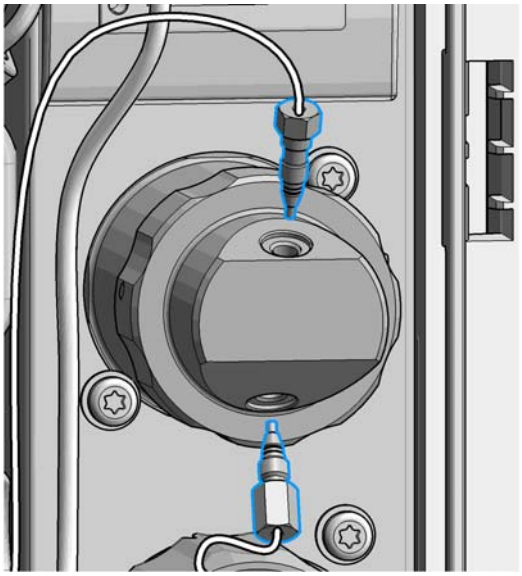
For proper installation, check the correct position of the tag.

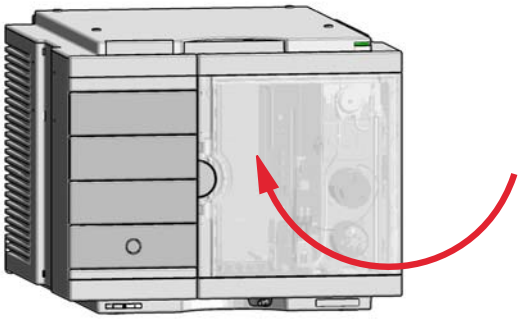
7 Fix the analytical head by pushing (1.) and rotating (2.) via twist and lock bayonet mechanism.





8 Reconnect the capillaries.



9 Close the front door. 	In the Instant Pilot exit the maintenance mode and select **Change metering device** function. OR In Agilent Lab Advisor software system screen exit **Service & Diagnostics (Tools) > Maintenance Positions > Change Metering Device** click **End** and wait until the metering device is in **Home** position. **10** Perform a pressure test.

Replace the Peristaltic Pump Cartridge

When	Tubing blocked or broken		
Parts required	**#**	**p/n**	**Description**
	1	5065-4445	Peristaltic pump with Pharmed tubing (default)
OR	1	5042-8507	Peristaltic pump cartridge, silicone tubing
OR	1	5042-9952	Peristaltic pump with Chemsure tubing

Preparations Remove the inlet filter of the solvent bottle which guides the solvent to the peristaltic pump to avoid syphoning effects.

WARNING

When opening capillary or tube fittings solvents may leak out.

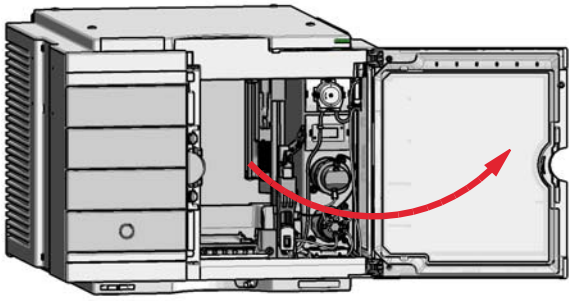
The handling of toxic and hazardous solvents and reagents can hold health risks.

➔ Please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.

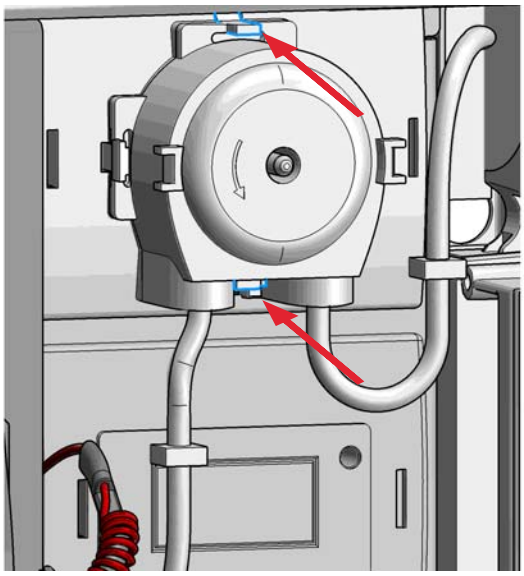
NOTE

The peristaltic pump cartridge is a replaceable unit. The tubing inside the pump is not replaceable.

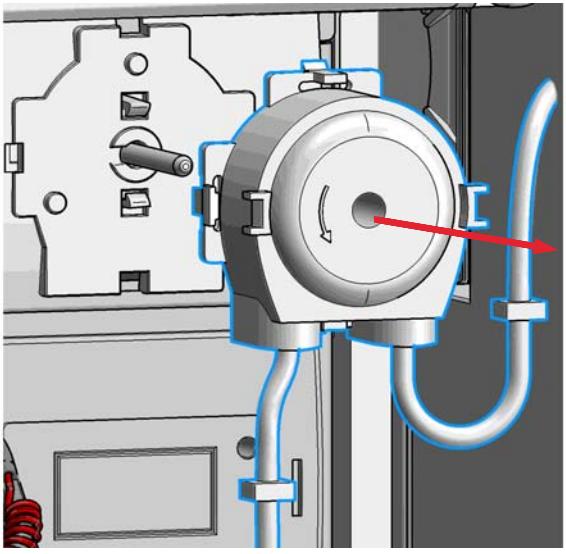
1 Open the front door.



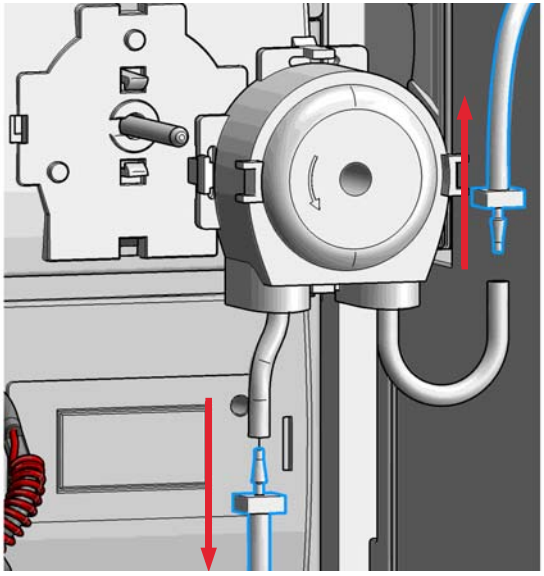
2 Press the two clips on the front of the peristaltic pump cartridge.



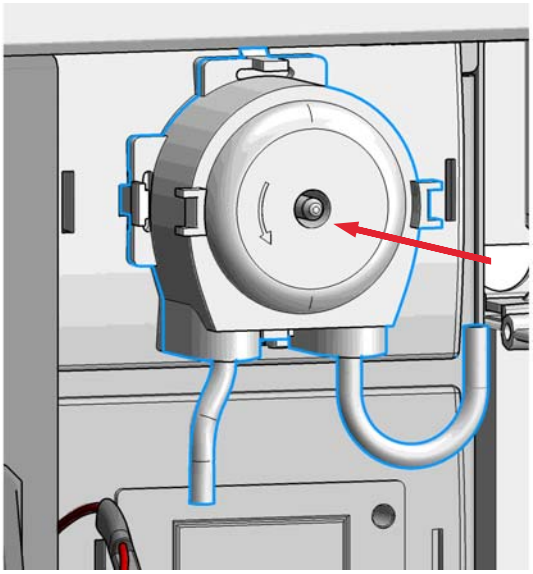
3 Pull the cartridge forward off the motor shaft.



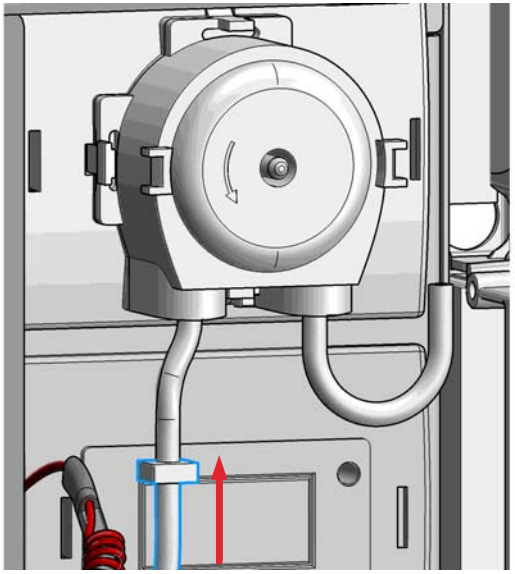
4 Disconnect the tubing coupler leading to the wash port and the tubing coupler coming from the solvent bottle.



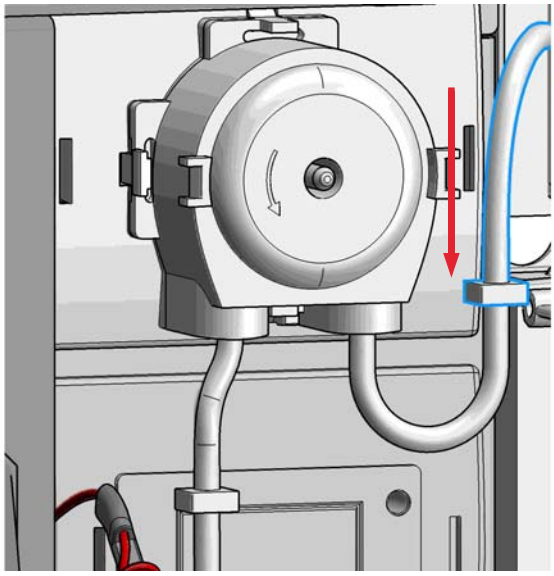
5 Push the new cartridge onto the motor shaft until the clips click into place.



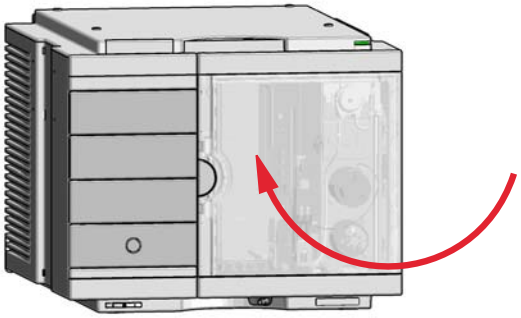
6 Connect the wash port tubing to the upper tubing of the new cartridge (use sand paper to get a good grip on the tubing).



7 Connect the inlet filter of the solvent bottle again. Use the syringe to draw enough solvent for completely filling of the peristaltic pump tubing before continuing to prime the peristaltic pump.



8 Close the front door.



Replace the Flushhead Seal

When	Flush head is leaking	
Tools required	**p/n**	**Description**
	8710-0510	Wrench open 1/4 — 5/16 inch
	8710-2392	Hex key 4 mm15 cm long T-handle
Parts required	**p/n**	**Description**
	5067-5918	Seal 500 µL

Preparations

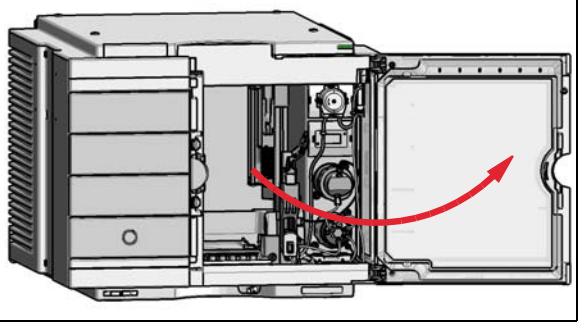
- Cleaning tissue
- Appropriate solvent like isopropanol or methanol

1 In the Instant Pilot start the maintenance mode and select **Change metering device** function.

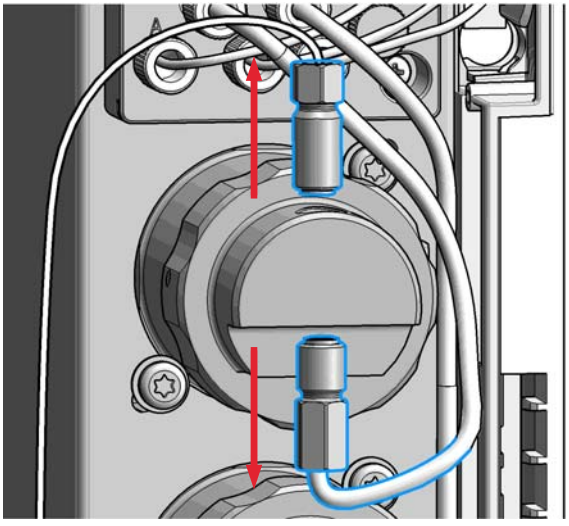
OR

In the Agilent Lab Advisor software select **Service & Diagnostics** in the system screen **(Tools) > Maintenance Positions > Change Metering Device**, click start and wait until the metering device is in maintenance position.

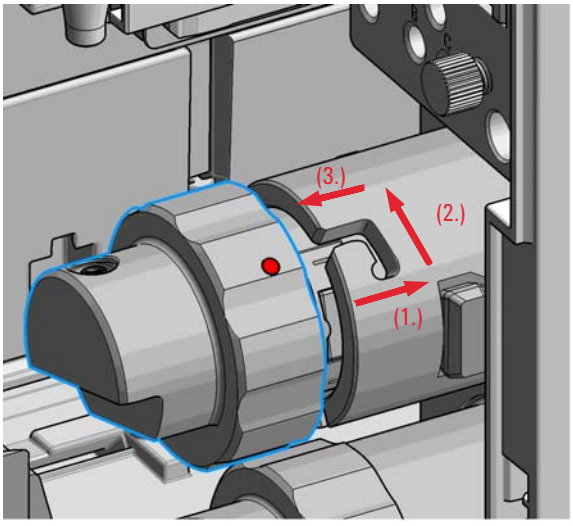
2 Open the front door.



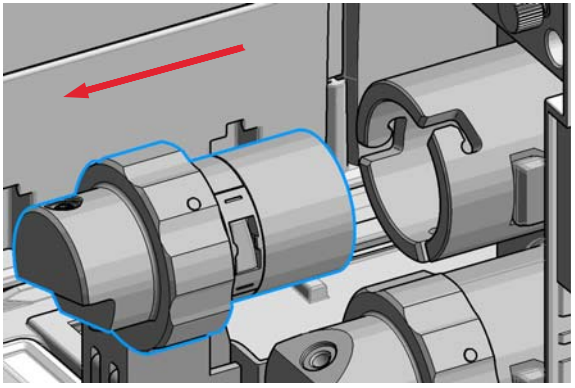
3 Remove capillaries and valves from the flush head.



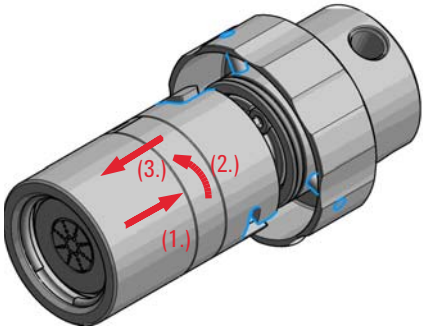
4 Press and turn the Flush Head a quarter left (bayonet fitting) and detach the metering device from the actuator.



5 Pull the flush head away from the hydraulic box



6 Press against the rear side of flush head and turn a quarter left (bayonet fitting) and separate the flush head, head body and the piston.

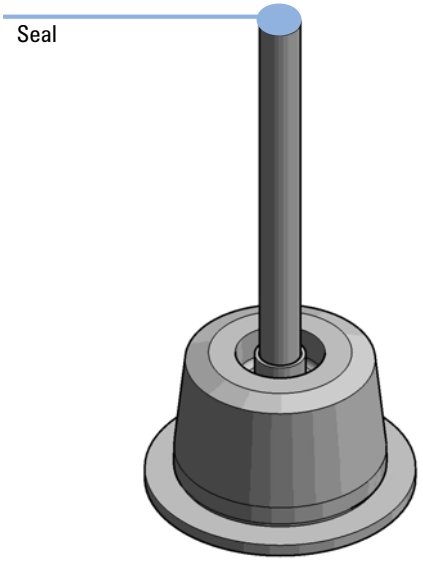


NOTE

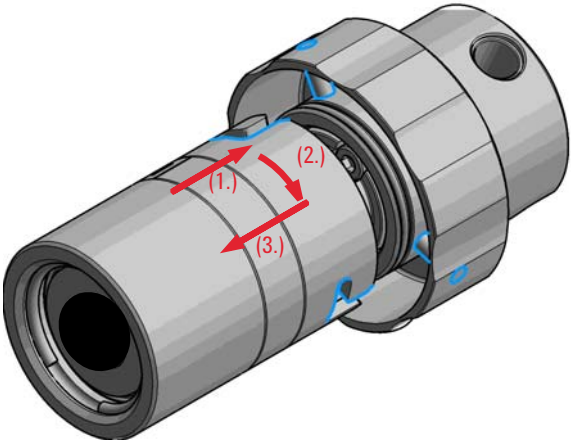
Be careful not to break the piston.

7 Remove the piston from the head body.

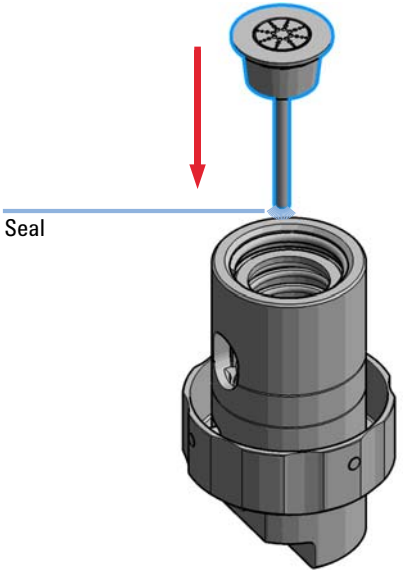
8 Carefully remove the metering seal from the tip of the piston.



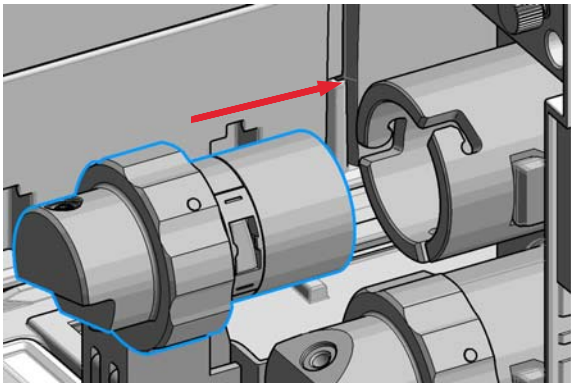
9 Reassemble the flush head and the head body (without piston).



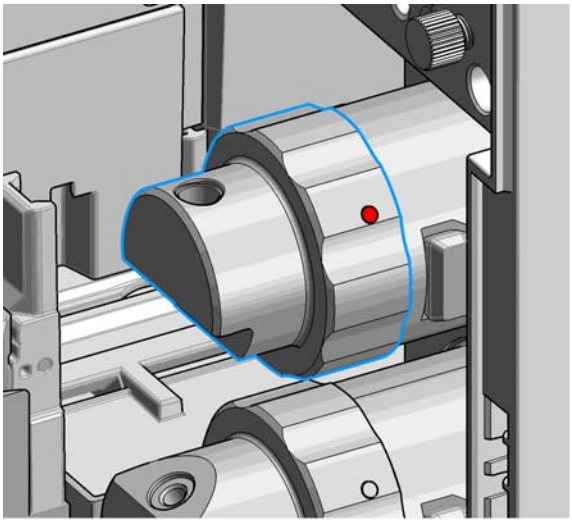
10 Carefully insert the piston with the new metering seal into the flush head assembly.



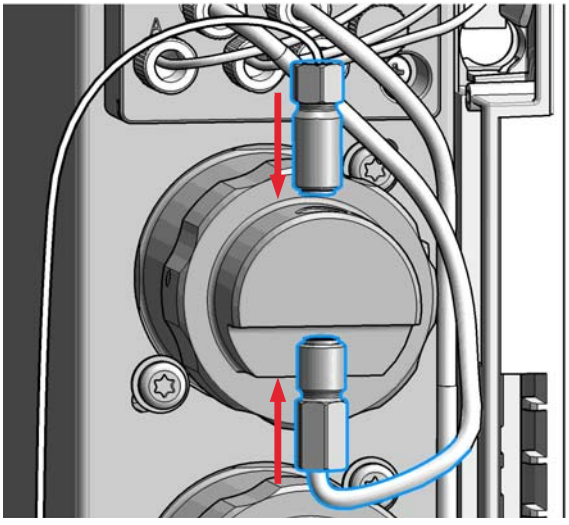
11 Reinstall the flush head to the actuator housing.



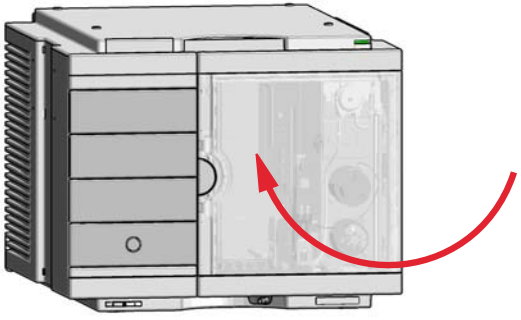
12 Fix the flush head.



13 Connect the capillaries.



14 Close the front door.

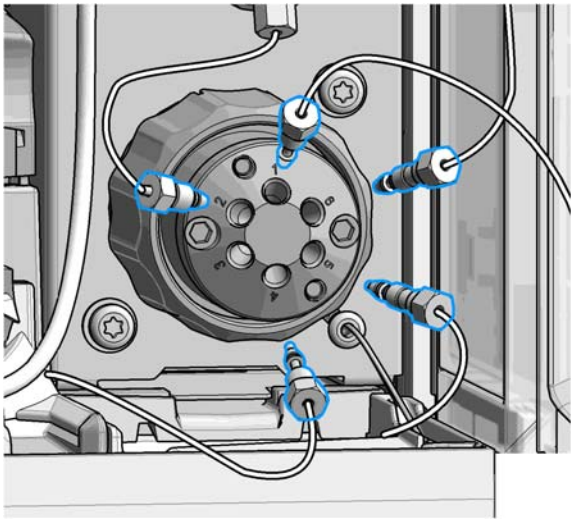


Replace the Injection Valve

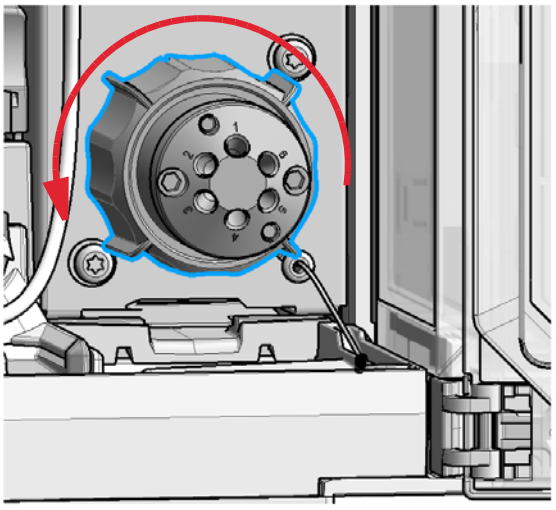
When	Add new injection valve or replace defective injection valve.		
Tools required	**Description**		
	Wrench 9/64		
Parts required	**#**	**p/n**	**Description**
	1	5067-4232	2pos/6port Injection Valve (VICI) 1300 bar (G7167B)
OR	1	5067-4230	Injection Valve Idex 600 bar (G7167A)
OR	1	5067-4260	2pos/8port Injection Valve Dual Needle 1300 bar
Preparations	Switch off the power of the Multisampler		

NOTE Please bear in mind that depending on which valve you have installed the images may slightly differ from the actual item.

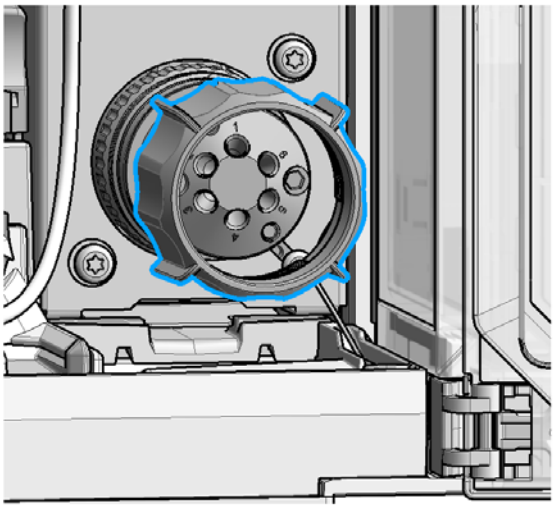
1 Disconnect the capillaries.



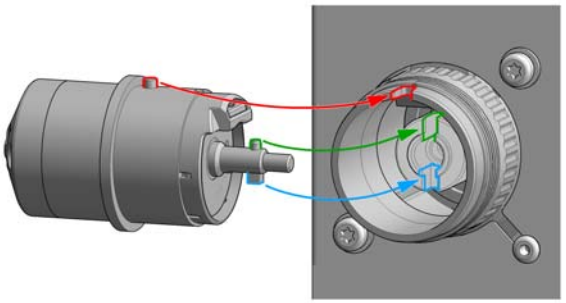
2 Turn the spanner nut counter clockwise until the injection valve head detaches from the hydraulic box (Do not use wrenches on the spanner nut).



3 Remove the spanner nut from the injection valve head.

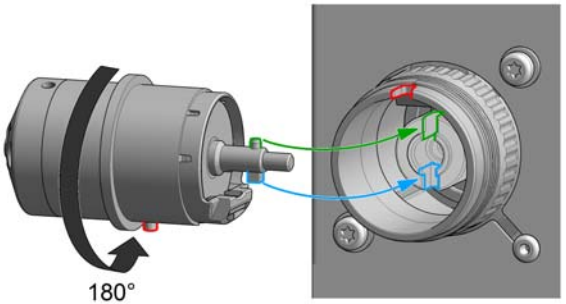


4 Take the replacment injection valve head and insert it into the open actuator slot of the hydraulic box. Rotate until the unions at the base of the replacement injection valve head and the valve actuator engage



OR

If the outside pin does not fit into the outside groove, you have to turn the valve head until you feel that the two pins snap into the grooves. Now you should feel additional resistance from the valve drive while continue turning the valve head until the pin fits into the groove.

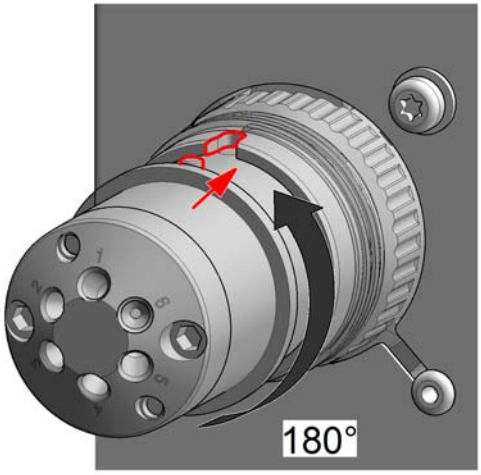


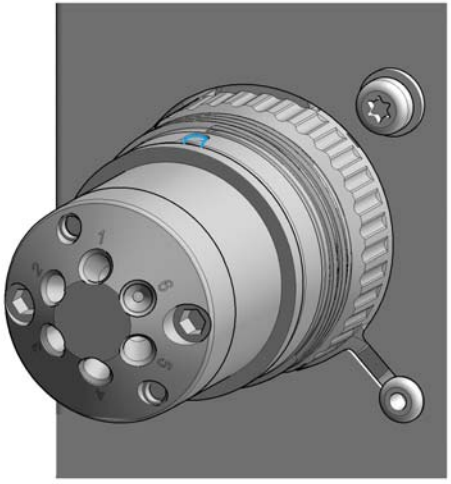
NOTE

Check the orientation of the rear side.

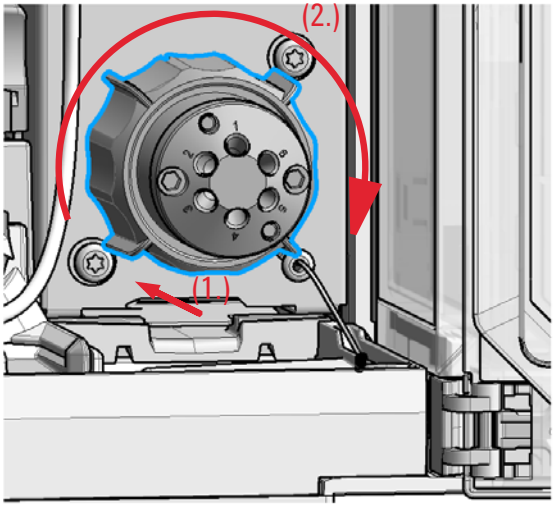
Verify the correct position of the Valve TAG.

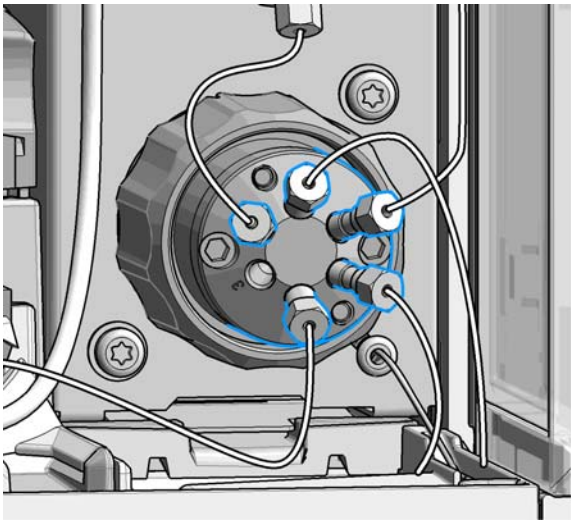
5 Continue to rotate until the clocking pin in the injection valve head align with the notch in the housing and press the replacement injection valve head into the actuator.





6 Replace the spanner nut (1.) and tighten clockwise (2.) (Hand tighten only, do not use wrenches on the spanner nut).



7 Reconnect the capillaries 	

Removing the Sample Loop-Flex

When If the sample loop flex is defective or damaged.

Tools required

p/n	Description
8710-0510	Wrench open 1/4 — 5/16 inch

Parts required

p/n	Description
G4267-60300	Sample Loop Flex 20 µL, right (red coded)
G4267-60400	Sample Loop Flex 40 µL, right (green coded)
G4267-60500	Sample Loop Flex 100 µL, right (blue coded)

Further sample loops for the Dual Needle option are available, see "Sample Loops and Capillaries (Dual Needle)" on page 228.

Preparations Finish any pending acquisition job and return any plate on the workspace back to the hotel.

WARNING

Risk of injury by uncovered needle

An uncovered needle is a risk of harm to the operator.

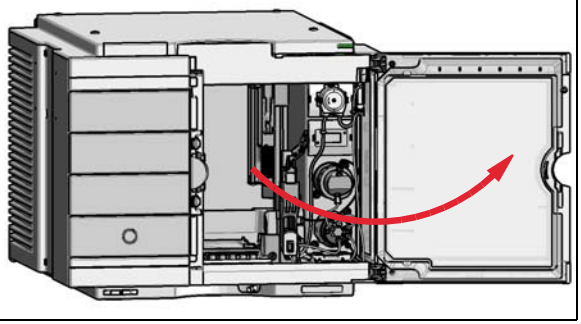
- ➔ Do not open the safety lock of the needle assembly
- ➔ Be careful working at the z-robot.
- ➔ Wear safety goggles, when removing the needle assembly.

1 In the Instant Pilot start the maintenance mode and select **Change needle/seat** function.

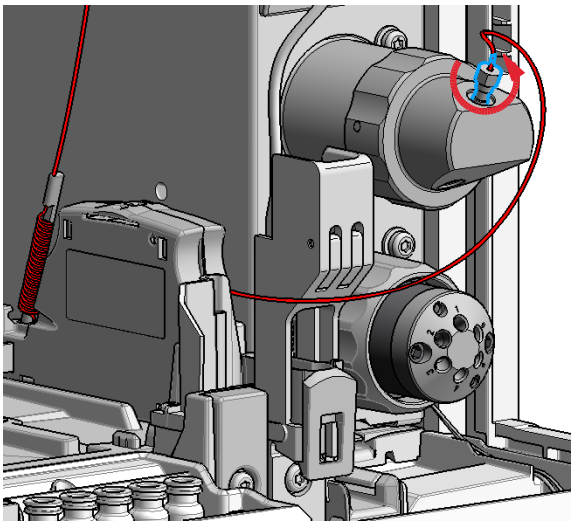
OR

In the Agilent Lab Advisor software select **Service & Diagnostics** in the system screen (**Tools**) **Maintenance Positions > Change Needle/Loop**, click **Start** and wait until the needle assembly is in maintenance position.

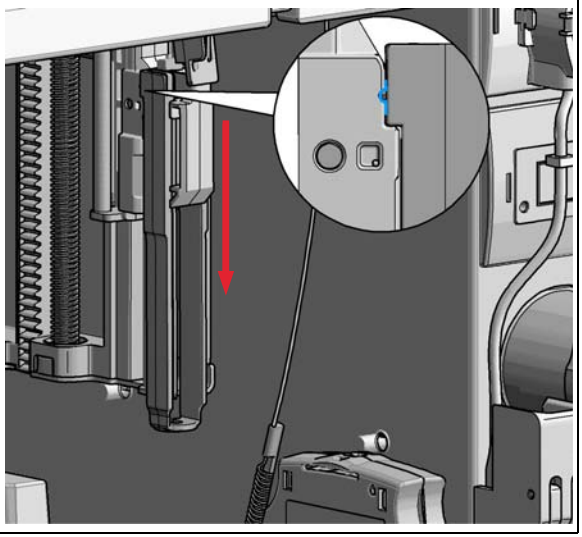
2 Open the front door.



3 The needle assembly is still connected to the loop capillary. Use a 1/4 inch wrench to loosen the fitting of the loop capillary connected to the analytical head.



4 Lock the needle in the safety position.



CAUTION

Damage of the loop
The loop shape may be damaged if the loop is stretched or bent too far.

➔ **Avoid to change the loop shape.**

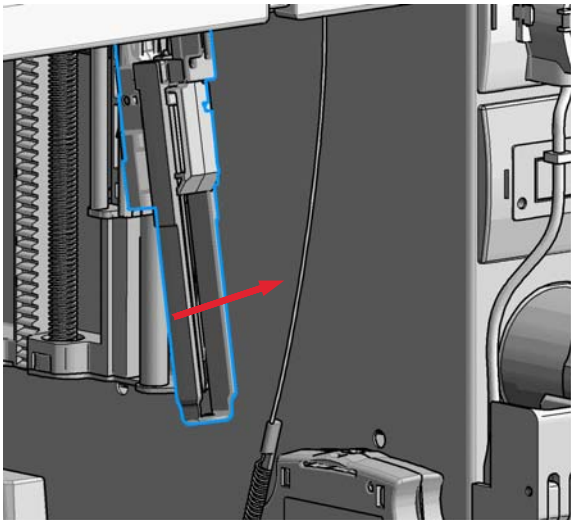
➔ **Do not pull or bend the loop too far.**

WARNING

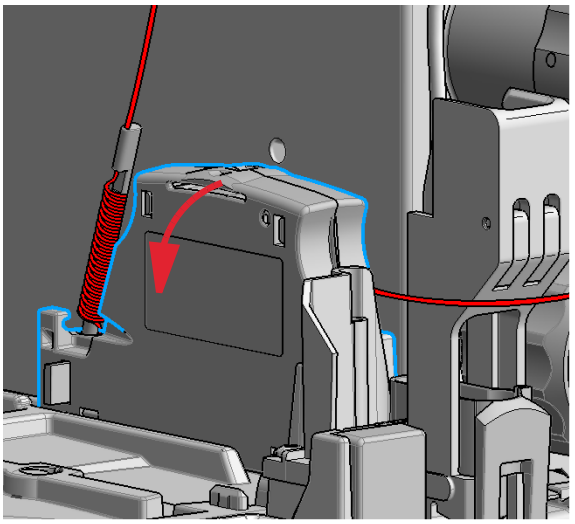
Sharp needle
Uncovered needles may cause injuries

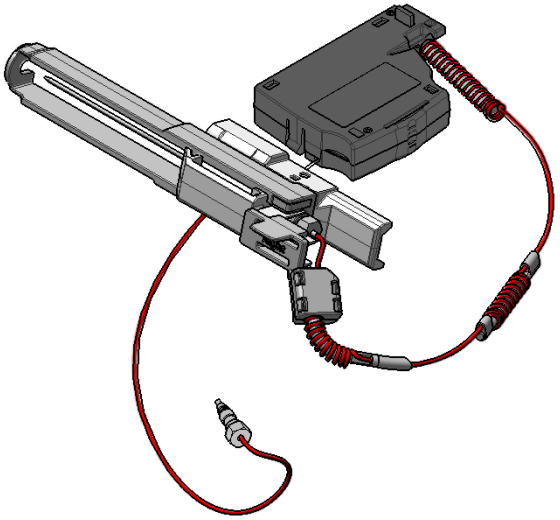
➔ **Make sure the needle is in the safety lock position.**

5 Remove the needle assembly by slightly pulling the needle cartridge.

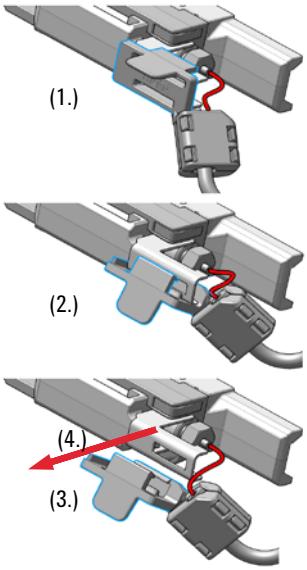


6 Remove the cartridge out of its proper position. By gently tilting and pulling it out of the work space of the multisampler.

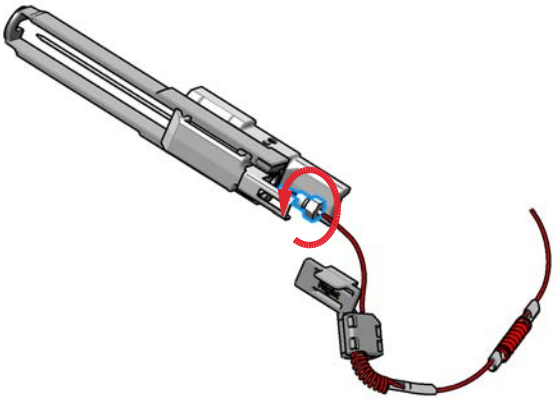




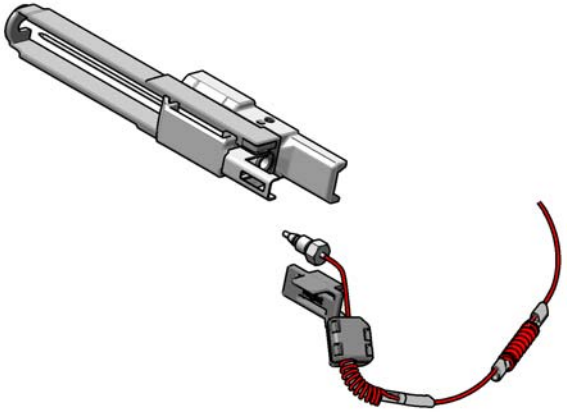
7 Remove the loop plastic adapter.



8 Use a 1/4 inch wrench to loosen the fitting of the loop capillary.



9 Remove the needle assembly.



Installing the Sample Loop-Flex

When If the sample loop flex is defective or damaged.

Tools required

p/n	Description
8710-0510	Wrench open 1/4 — 5/16 inch

Parts required

p/n	Description
G4267-60300	Sample Loop Flex 20 µL, right (red coded)
G4267-60400	Sample Loop Flex 40 µL, right (green coded)
G4267-60500	Sample Loop Flex 100 µL, right (blue coded)

Further sample loops for the Dual Needle option are available, see "Sample Loops and Capillaries (Dual Needle)" on page 228.

Preparations Finish any pending acquisition job and return any plate on the workspace back to the hotel.

WARNING

Risk of injury by uncovered needle

An uncovered needle is a risk of harm to the operator.

➔ Do not open the safety lock of the needle assembly

➔ Be careful working at the z-robot.

➔ Wear safety goggles, when removing the needle assembly.

CAUTION

Mismatching sample loop configuration

Damage to the system

➔ Make sure, that the sample loop configuration matches to the hardware installed.

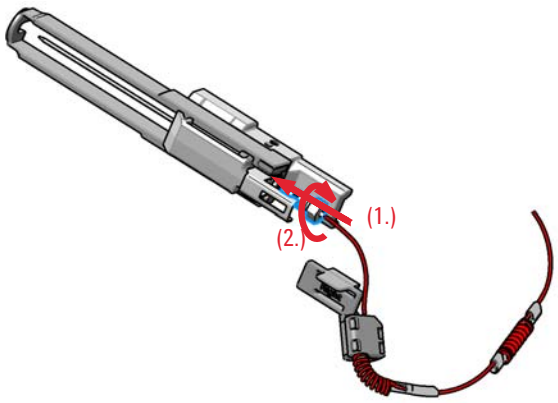
NOTE

If you have changed the sample loop, verify that the correct sample loop is configured in the CDS (see "Setting up the Autosampler with Agilent Open Lab ChemStation" on page 77).

NOTE

For details on the setup of the dual-needle system, see"Modify Capillaries" on page 88.

1 Install the loop capillary on top of the needle cartridge (1.) and tighten the fitting hand tight (2.).



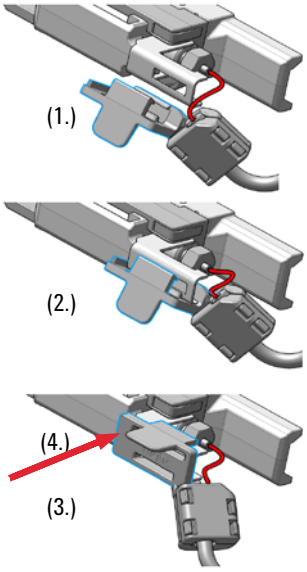
CAUTION

Blockages

→ **Do not overtighten the fitting. A quarter turn should be sufficient.**

2 Then use a 1/4 inch wrench to tighten the fitting of the loop capillary.

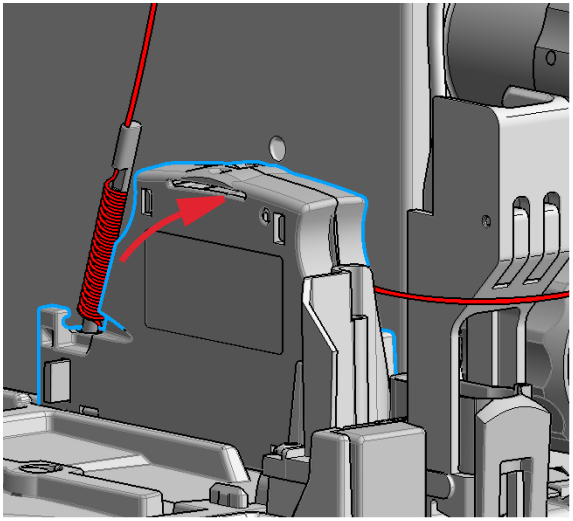
3 Install loop plastic adapter.



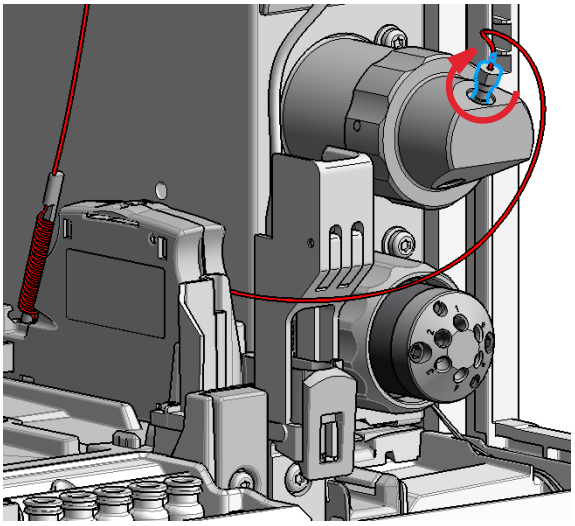
NOTE

Verify the sample loop info on the plastic adapter. A left or a right sample loop must be installed in the correct slot of the needle parkstation. For single needle, the default position is on the right.

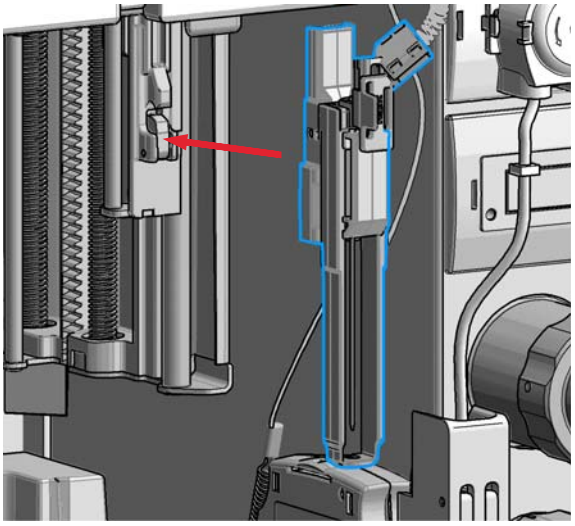
4 Click the sample loop cartridge in the designated location and keep the right orientation.



5 Install the shorter capillary of the sample loop cartridge to the analytical head.



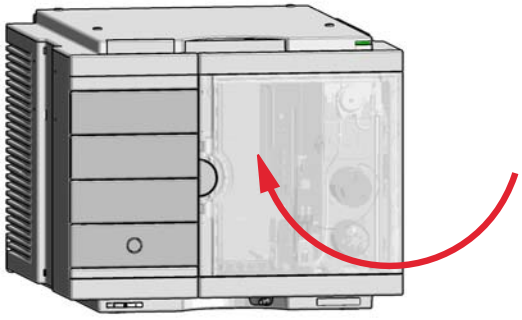
6 Pinch and reinsert the needle assembly and the connected sample loop capillary into the z- arm coupler.



NOTE

Check the tension of the loop capillary. This must be forced and guided to the hydraulic box to prevent it from being caught by the Z-drive.

7 Close the front door.



In the Instant Pilot close **Change needle /seat**.

OR

In Agilent Lab Advisor software **Change needle/loop**. Click **NEXT** and wait until the needle is in the needle park station.

Click **Back** to leave the Maintenance window.

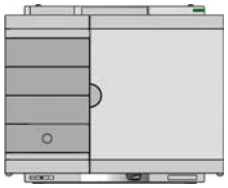
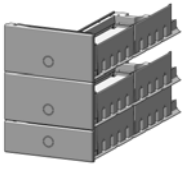
NOTE

If you need an autoreferencing step included you must choose the change needle procedure

Replace the Dummy Drawer

Optional Configurations

Table 16 Overview on optional configurations (examples for uniform types)

		1H	2H	3H	Dummy-Drawer
	**Delivery Status**	-	G7167-60020 1x	-	G4267-60024 3x
	**Up to 8 single height drawers** 16 positions Shallow wellplates and MTP Max Sample capacity 1536 / 6144 samples (96 Shallow Wellplates / 384 MTP)	G7167-60021 8x	-	-	-
	**Up to 4 Dual Height drawers** 8 positions Vials (2 mL), deep well plates, MTP, Eppendorf Max Sample capacity 432 / 3072 samples (2 mL Vials/ 384 MTP)	-	G7167-60020 4x	-	-
	**Up to 2 Drawers Triple Height** 4 positions (2H or 2*1H option left over) Vials (6 ml), deep well plates, MTP, Eppendorf Max Sample capacity 60 / 216/ 1536 samples (6 mL Vials/ 2 mL Vials/ 384 MTP)	-	G7167-60020 1x	G7167-60022 2x	-

NOTE

Mixed configurations are possible (for example 1x3H- with 1x2H- and 3x1H-drawer).

All positions in the Sample Hotel must be filled either with dummies or drawers. The drawers must be installed from bottom to top.

Installing and Replacing of Drawers (Upgrade Drawer Kit)

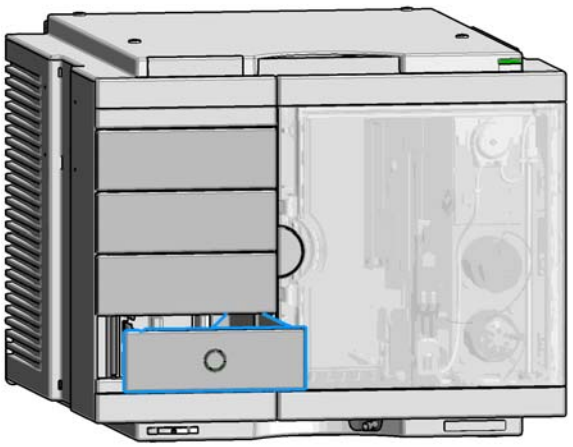
Tools required	Description
	Screwdriver

Parts required	p/n	Description
	G7167-60020	Drawer 2H
	G7167-60021	Drawer 1H
	G7167-60022	Drawer 3H

NOTE Before you start the new drawer installation you have to remove the lower drawer (2H drawer = default configuration) from the Sample Hotel.

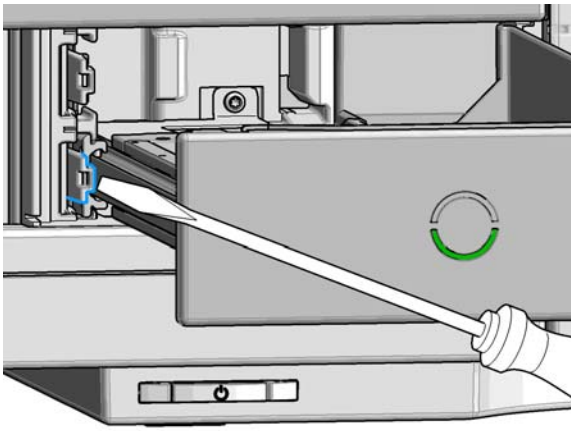
NOTE For best cooling performance the 2H drawer must be installed in the lowest position.

1 Open the drawer.

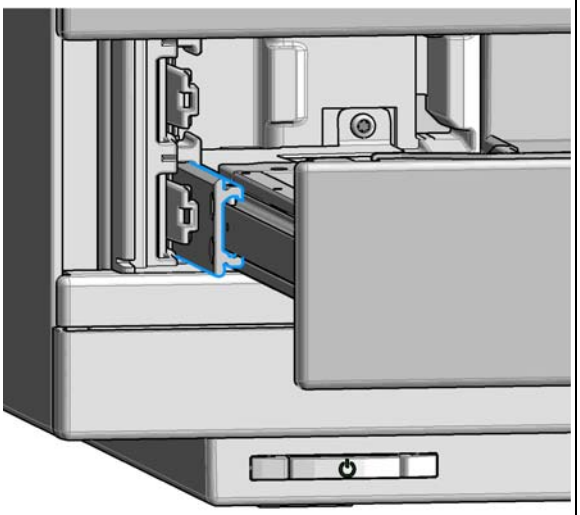


2 Pull the drawer completely out.

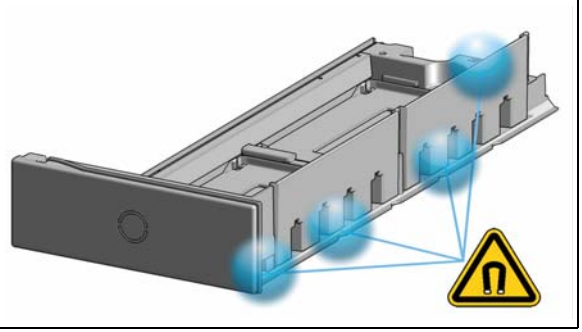
3 Unlatch the drawer: Use a screwdriver to press the clamping lever lightly to the left.



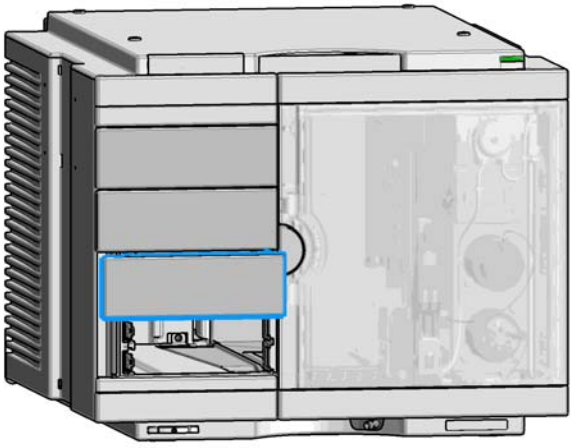
4 Remove the drawer from the rail guide.



The drawer is now out of the hotel.



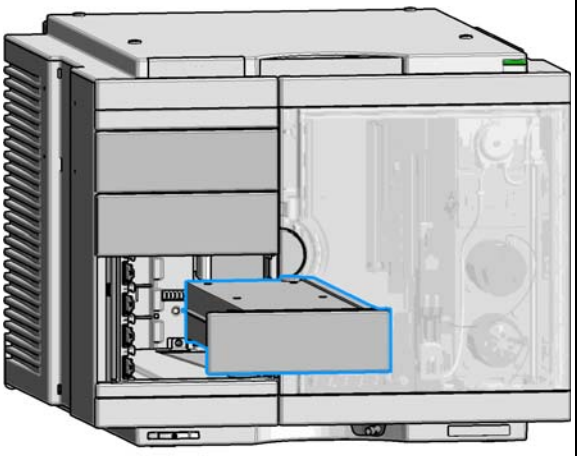
5 Grab in the recession below the dummy drawer front panel (1.) and lift the left side (2.).



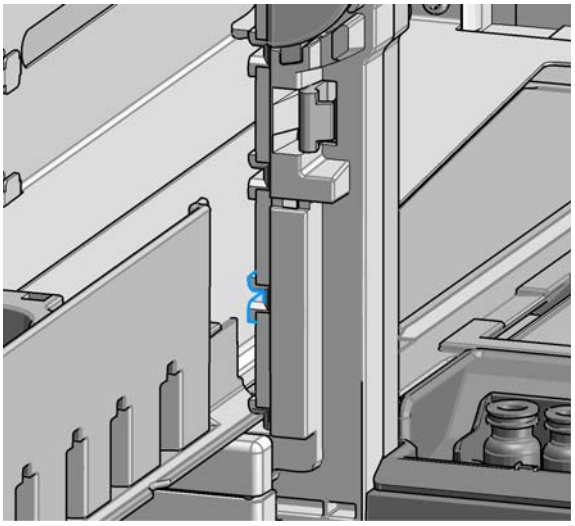
6 Remove the dummy drawer.

NOTE

At this stage remove all other dummies that will be replaced by hotel drawers.



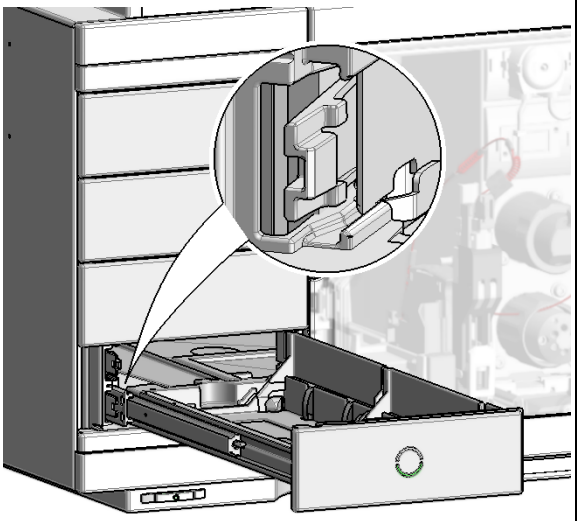
7 Place the new drawer horizontally into the sample hotel. Check that the drawer matches the middle bracket of the sample hotel.



8 Push until the complete drawer locks in place.

NOTE

Take care that the clamping lever locks.



NOTE

Always fill sample hotel completely (no empty drawer slots). Otherwise the drawers can't be configured in the software.

9 Configure the hotel drawers in the controller software (see the Online Help of the software for details).

Configuration of the Hotel Drawers

The configuration of your drawers is necessary to detect the new drawer configuration for your CDS system. When a wrong configuration is detected there will be a mismatch in your CDS system and your are not able to use the new drawers. The new drawer configuration is active and stored after you have done the Drawer Configuration.

Configure the Hotel Drawers in the Control Software

Software required

OpenLAB (A.02.01 or above)

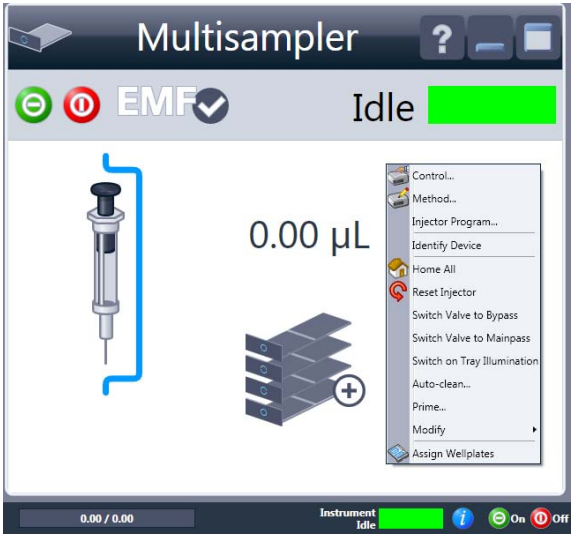
LC driver (A.02.10 or above

Preparations

- Stop the acquisition run.
- Remove the sample containers (trays and well plates) from workspace.
- Complete the drawer installation.
- Remove the sample containers (trays and well plates) from the drawers.
- Verify that all sample trays (palettes) are installed in their drawers.
- All open drawers and dummies have to be closed and installed properly.

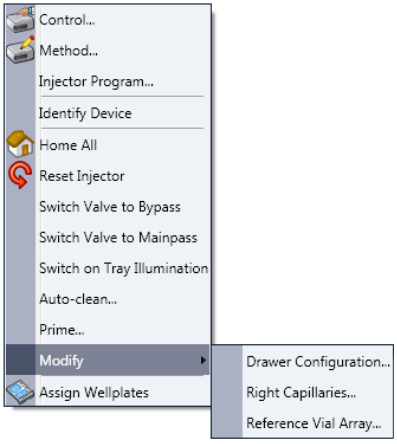
1 Start OpenLAB CDS ChemStation Edition.

2 Right-click on the **Multisampler** GUI.



3 Select **Modify > Drawer Configuration** in the GUI screen.

NOTE For correct detection, it is necessary to remove all sample containers (for example 54 vial tray or well plates).



4 Follow the Setup or Change configuration screen.

5 System is ready after the robot has done Auto Referencing.

Configure the Hotel Drawers in Lab Advisor

Software required Lab Advisor (B.02.05 or above)

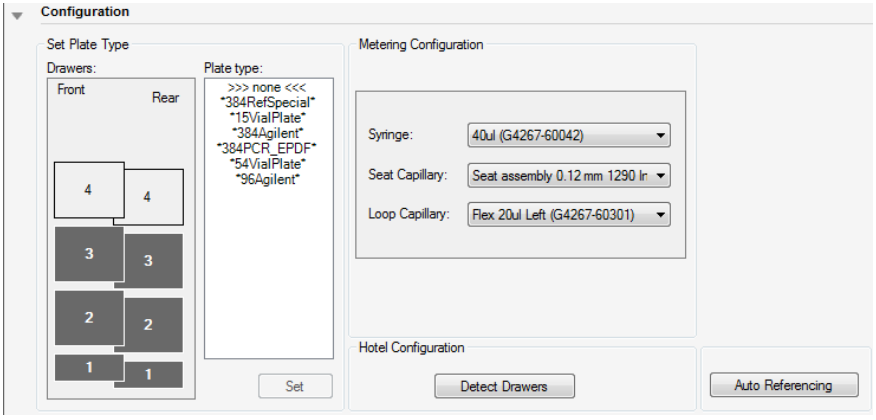
Preparations

- Stop the acquisition run.
- Remove the sample containers (trays and well plates) from workspace.
- Complete the drawer installation.
- Remove the sample containers (trays and well plates) from the drawers.
- Verify that all sample trays (palettes) are installed in their drawers.
- All open drawers and dummies have to be closed and installed properly.

1 Start the Lab Advisor Software.

2 Connect the instrument and select **Instrument Control** in the system screen.

3 Switch In the **Configuration** menu of the Multisampler. Select **Detect Drawers** in the **Hotel Configuration**.



4 Follow the Detect Hotel Configuration screen to detect the physically available drawers.

NOTE For correct detection, it is necessary to remove all sample containers (for example 54 vial tray or well plates).

5 System is ready after the robot has done Auto Referencing.

Remove the Sample Cooler

WARNING

Heavy weight

The module is heavy (>22 kg (>46 lbs)).

➔ Carry the module at least with 2 people.

➔ Avoid back strain or injury by following all precautions for lifting heavy objects.

➔ Ensure that the load is as close to your body as possible.

➔ Ensure that you can cope with the weight of your load.

CAUTION

Routing of the condensation tubing

Proper routing of the condensation tubing is critical for correct condensate drainage.

➔ Do not place the sampler directly on the bench.

CAUTION

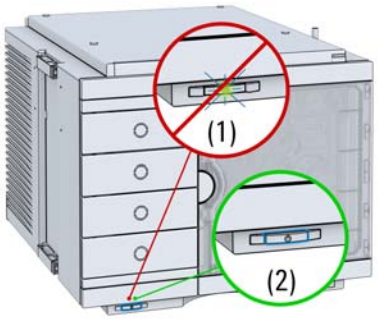
Condensate inside the cooler

Damage to the electronics

➔ Unplug the power cords.

➔ Drain off all condensate before dismounting the sample cooler.

➔ Make sure that there is no condensate left.

1  Power switch (1) On (2) Off	**Next Steps:** **2** Remove the power cable from the module. **3** Open the four screws on cooler cover. **4** Slide the sample cooler the half way out. **5** Remove power and the signal cable. **6** Slide the cooler completely out. **7** Place the sample cooler on the bench.

Install the Sample Cooler

When	If the cooler is damaged or defective.	
Tools required	**Description**	
	Screwdriver, Pozidriv #1 PT3	
Parts required	**p/n**	**Description**
	G7167-60005	Sample cooler

CAUTION

Routing of the condensation tubing

Proper routing of the condensation tubing is critical for correct condensate drainage.

➔ Do not place the sampler directly on the bench.

CAUTION

Condensate inside the cooler

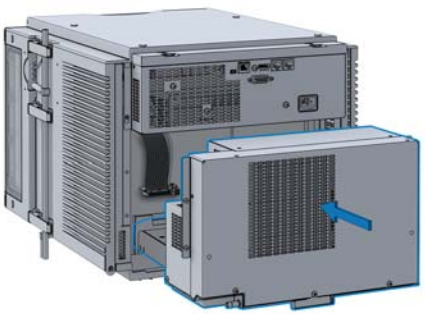
Damage to the electronics

➔ Unplug the power cords.

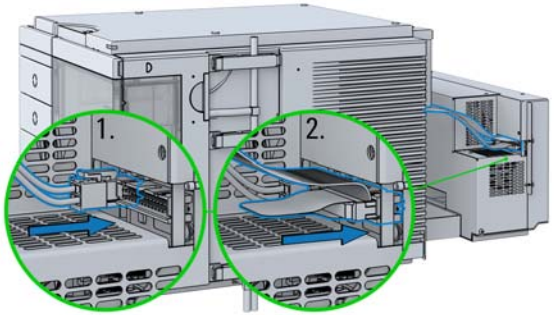
➔ Drain off all condensate before dismounting the sample cooler.

➔ Make sure that there is no condensate left.

1 Slide in halfway



2



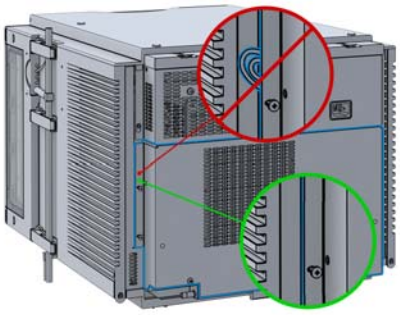
CAUTION

Damage to the cables

➔ **Do not bend or pinch the cables.**

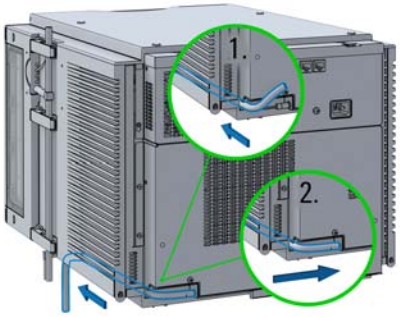
➔ **Fit in the cooler perfectly.**

3



4

5 Install the condensate tubing correctly.

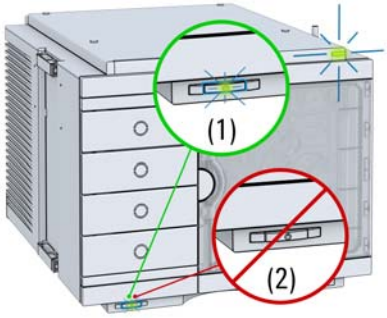


CAUTION

Damage to the sample cooler

➔ **Wait at least 30 min before switching on the compressor of the sample cooler.**

6

7  Power switch (1) On (2) Off	

Replace the Module Firmware

When

The installation of newer firmware might be necessary
- if a newer version solves problems of older versions or
- to keep all systems on the same (validated) revision.

The installation of older firmware might be necessary
- to keep all systems on the same (validated) revision or
- if a new module with newer firmware is added to a system or
- if third party control software requires a special version.

Tools required

	Description
	Agilent Lab Advisor software
OR	Instant Pilot G4208A (only if supported by module)

Parts required

#	**Description**
1	Firmware, tools and documentation from Agilent web site

Preparations

Read update documentation provided with the Firmware Update Tool.

To upgrade/downgrade the module's firmware carry out the following steps:

1 Download the required module firmware, the latest FW Update Tool and the documentation from the Agilent web.
http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761

2 For loading the firmware into the module follow the instructions in the documentation.

Module Specific Information

There is no specific information for this module.

10
Parts for Maintenance and Upgrade or Options

Hotel Drawer 220
Analytical Head Assembly 40 µL 221
Analytical Head Assembly 100 µL 222
Analytical Head Assembly 900 µL 223
Flush Head Assembly 500 µL 224
2ps 6pt Injection Valve VICI 225
2ps 6pt Injection Valve IDEX 226
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Sample Loops and Capillaries (Dual Needle) 228
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Door Assy 233
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Tubing Kit Sampler Standard 235
Tubing Kit Sampler Multi-Wash 236
Sample Cooler 237

This chapter provides information on parts material required for the module.

Hotel Drawer

Item	p/n	Description
1	G7167-60021	Drawer 1H (2 p/k (including 2*G4267-60206 Sample Container))
2	G7167-60020	Drawer 2H (including 2*G4267-60205 Sample Container)
3	G7167-60022	Drawer 3H (2 p/k (including 2*G4267-60205 Sample Container))
	G4267-60024	Dummy Drawer (not shown)

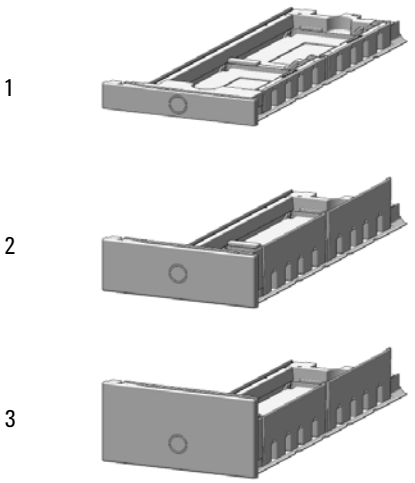


Figure 40 Hotel drawer

Analytical Head Assembly 40 µL

Item	p/n	Description
	G4267-60042	Analytical Head, 40 µL
1	G4267-60423	Head Assembly, 40 µL
2	0905-1717	Metering seal 40 µL
3	G4267-60425	Support ring 40 µL Head including backup ring
4	0515-4384	Screw
5	G4267-60432	Spring Adapter Assembly
6	5067-5620	Piston ceramic 40 µL
	5043-1000	O-Ring (not shown)

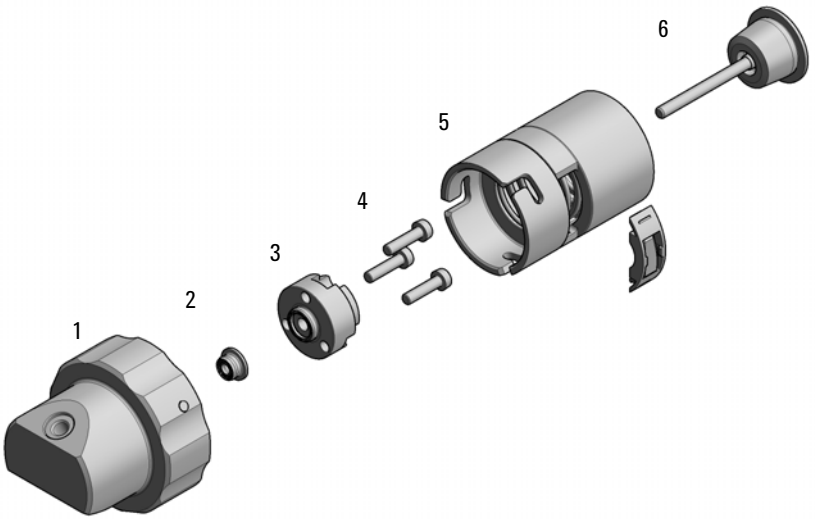


Figure 41 Analytical head assembly, 40 µL

Analytical Head Assembly 100 µL

Item	p/n	Description
	G4267-60043	Analytical Head, 100 µL
1	G4267-60433	Head Assembly, 100 µL
2	0905-1719	Metering seal 100 µL
3	G4267-60435	Support ring 100 µL Head including backup ring
4	0515-1052	Screw 2.5 mm hex
5	G4267-60432	Spring Adapter Assembly
6	5067-5678	Piston ceramic 100 µL
	5043-1000	O-Ring (not shown)

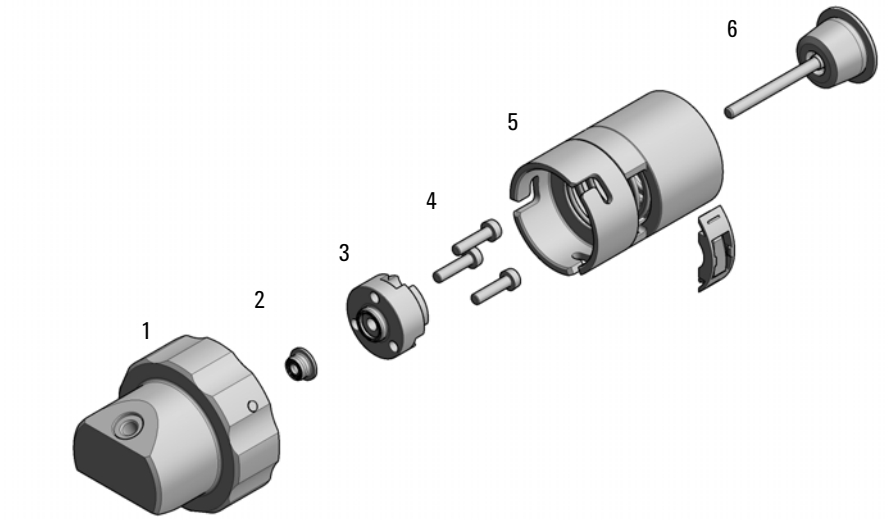
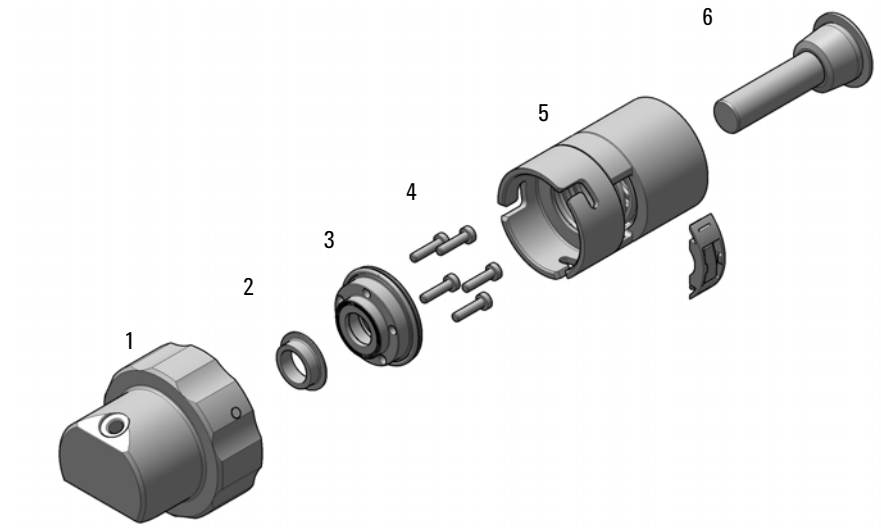


Figure 42 Analytical head assembly, 100 µL

Analytical Head Assembly 900 µL

Item	p/n	Description
	G4267-60046	Analytical head, 900 µL, 400 bar
1	G4267-60461	Head Assembly, 900 µL
2	0905-1294	Metering seal, 900 µL
3	G4267-60463	Seal Support Assembly, 900 µL
4	SCREW-SKT	SCREW-SKT HD CAP M2.5 X 0.45 10MM LG (not available)
5	G4267-60432	Spring Adapter Assembly
6	G4267-60462	Piston Assembly, 900 µL
	5043-1000	O-Ring (not shown)



Flush Head Assembly 500 µL

Item	p/n	Description
	G4267-60049	Flush head, 500 µL
1	G4267-60491	Flush Head Assembly, 500 µL
2	5023-2473	Sealing Plate 500 µL
3	G4267-60482	Cylinder Assembly, 500 µL
4	5067-5918	Seal 500 µL
5	0515-5167	Screw
6	1410-1881	Bearing-Sleeve 8 mm-ID 10 mm-OD 10 mm-LG PI
7	G4267-60432	Spring Adapter Assembly
8	5067-5919	Piston Assembly 500 µL
9	G4267-60451	Pump Valve IN
10	G4267-60452	Pump Valve Out
	5043-1000	O-Ring (not shown)

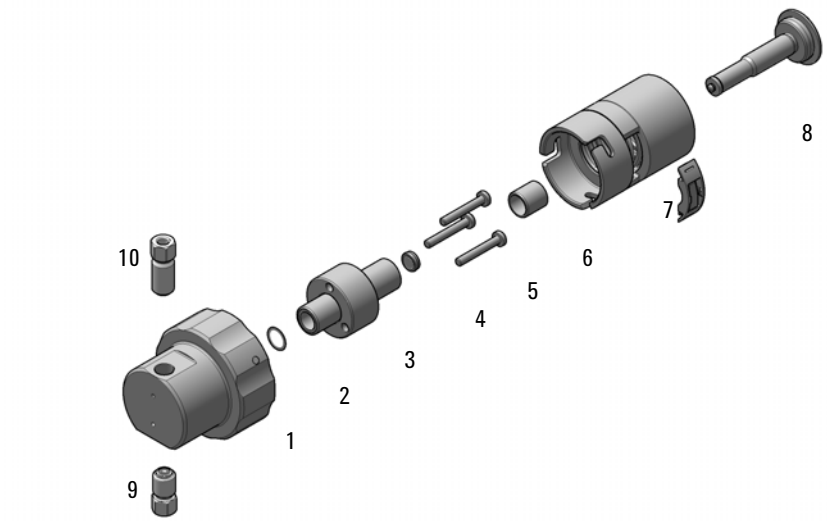


Figure 43 Flush head assembly, 500 µL

2ps 6pt Injection Valve VICI

Item	p/n	Description
	5067-4232	2pos/6port Injection Valve (VICI) 1300 bar (G7167B)
1	5068-0019	Stator screws
2	5068-0197	Stator head
3	5068-0198	Rotor Seal 1300 bar (PEEK)
	5500-1159	Capillary ST 0.17x100 SX/S-2.3 Metering Device to Injection Valve
	5067-4650	Capillary ST 0.12 mm x 150 mm SL/SX Pump to sampler
	5500-1157	Capillary, ST, 0.12 mmx500 mm Sampler to column compartment
	5067-6127	Blank Nut SL

NOTE For the VICI Valve SL/SX fittings are mandatory.

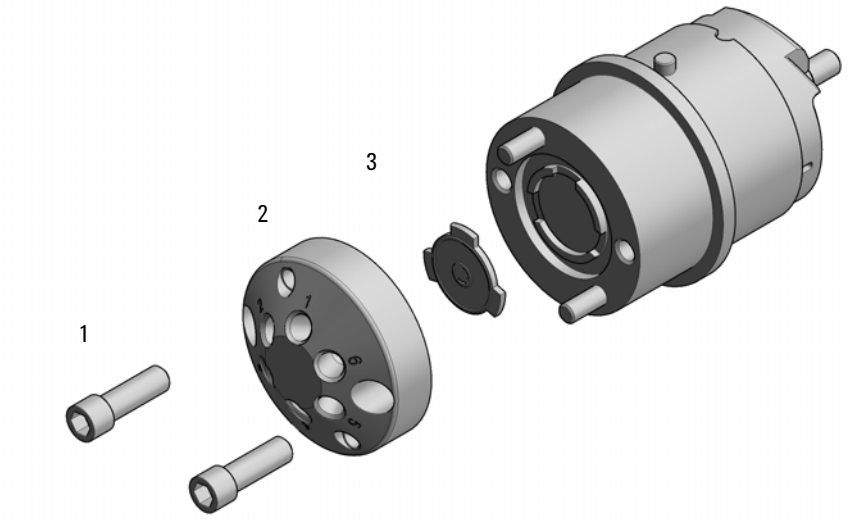


Figure 44 Injection valve assembly (VICI)

2ps 6pt Injection Valve IDEX

Item	p/n	Description
	5067-4230	Injection Valve Idex
1	1535-4857	Stator screws
2	5068-0208	Stator head
	5068-0120	Stator ring
3	5068-0209	Rotor Seal 600 bar (PEEK)
4	1535-4045	Bearing ring

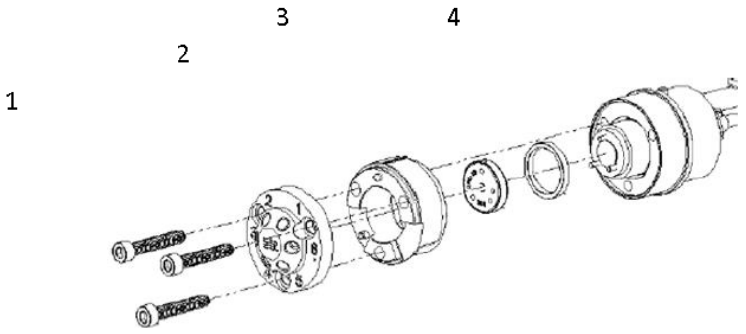


Figure 45 Injection valve assembly (IDEX)

Injection Valve with Actuator

Item	p/n	Description
1	5067-4232	2pos/6port Injection Valve (VICI)
2	5043-0291	Lock Nut
3	5188-8030	Tag Reader
4	5067-4162	Direct-Actuator-50 Assembly

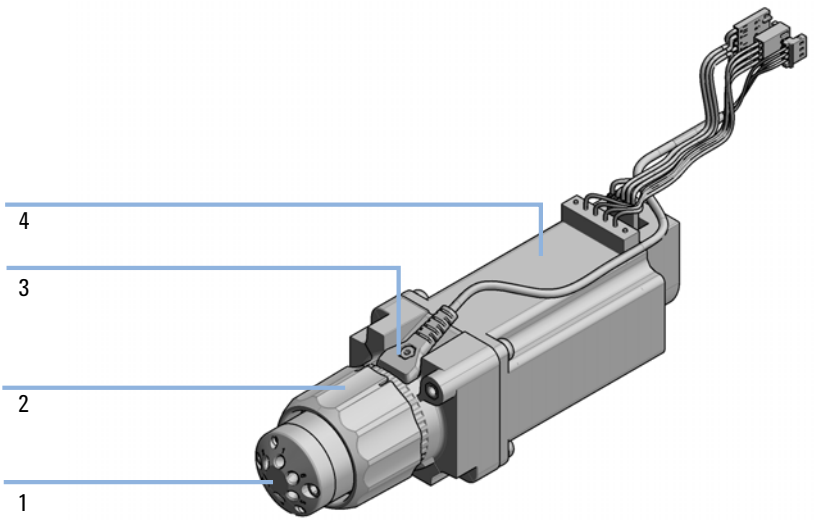


Figure 46 Injection valve with actuator

Sample Loops and Capillaries (Dual Needle)

Dual needle Sample Loops right

p/n	Description
G4267-60311	Sample Loop 20 µL right Dual needle
G4267-60411	Sample Loop 40 µL right Dual needle
G4267-60511	Sample Loop 100 µL right Dual needle
G4267-68511	Sample Loop 500 µL right Dual needle
G7167-68911	Sample Loop 900 µL right Dual needle

Dual needle Sample Loops left

p/n	Description
G4267-60301	Sample loop 20 µL left Dual needle
G4267-60401	Sample loop 40 µL left Dual needle
G4267-60501	Sample loop 100 µL left Dual needle
G4267-68501	Sample Loop 500 µL left Dual needle
G7167-68901	Sample Loop 900 µL left Dual needle

Capillaries for the Dual Needle Option

p/n	Description
5500-1225	Capillary ST 0.12 mm x 180 mm SL-SL Port 4 Peripheral Valve/Port 8 Injection Valve
5500-1226	Capillary ST 0.17 mm x 180 mm SL-SL Port 2 Injection Valve/ Port 1 Peripheral Valve
5500-1227	Capillary ST 0.17 mm x 150 mm SL-SL Port 3 Peripheral Valve/Metering Device bottom
5500-1228	Capillary ST 0.3 mm x 80 mm SL-SL Metering Device Top/Port 6 Peripheral Valve
5500-1229	Capillary ST 0.3 mm x 180 mm SL-SL Port 4 Injection Valve/Port 5 Peripheral Valve

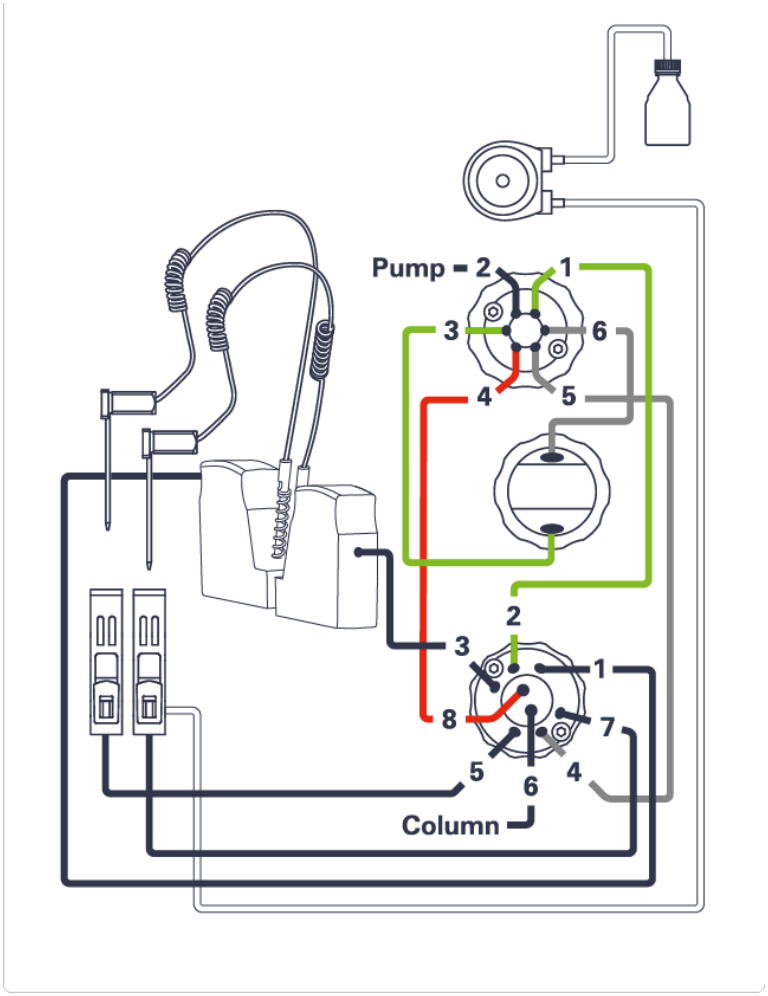


Figure 47 Capillary connections (Dual Needle Option)

NOTE Important for precision and avoiding of retention time shifts: only these sample loops must be used for the dual needle option.

NOTE It is mandatory that the configuration of the dual needle system, especially sample loops, must match to the installed hardware to avoid damage to the system.

3Pos/6Port Peripheral Valve Dual Needle

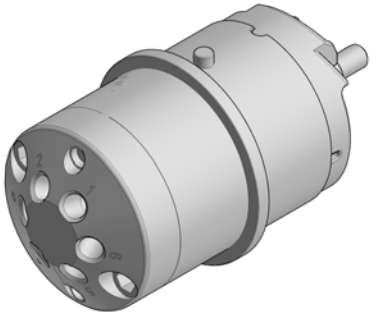


Figure 48 Peripheral valve (dual needle)

p/n	Description
5067-4256	3pos/6port Peripheral Valve DN 1300 bar
5068-0229	Rotor Seal
5068-0197	Stator head

2Pos/8Port Injection Valve Dual Needle

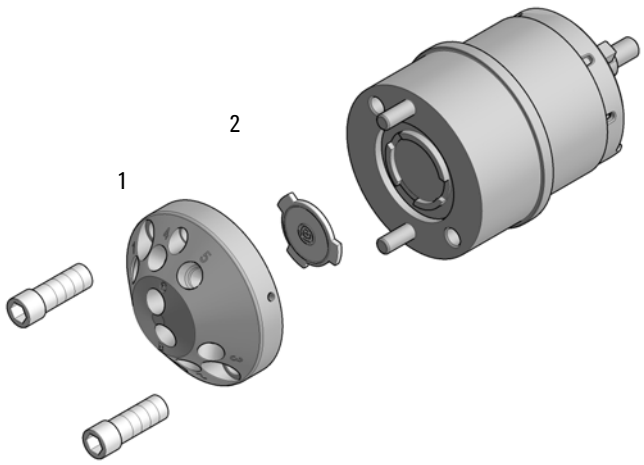


Figure 49 Injection valve (dual needle)

Item	p/n	Description
	5067-4260	2pos/8port Injection Valve Dual Needle 1300 bar
1	5068-0231	Stator
2	5068-0232	Rotor Seal

Needle Port Assembly

Item	p/n	Description
1	G4267-60044	Needle Port Assembly Station
2	G4267-40045	Needle port Adapter

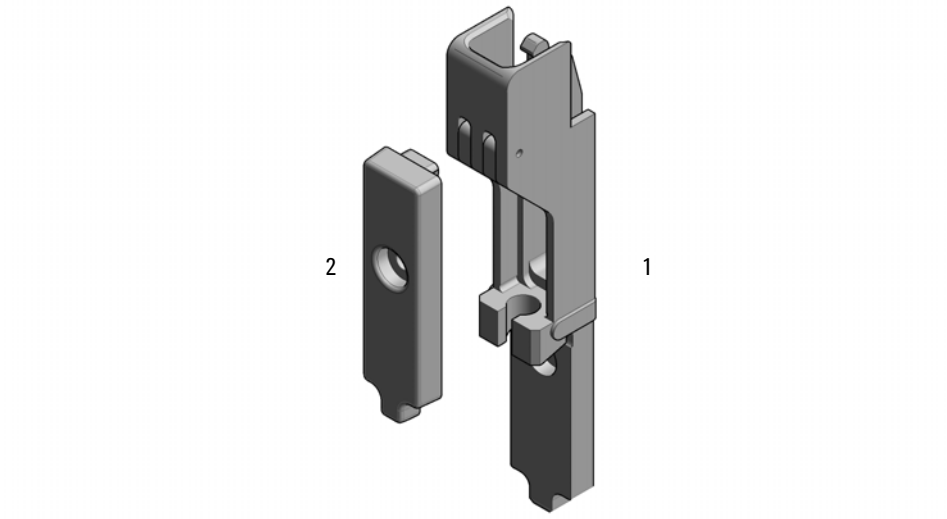


Figure 50 Needle port assembly

Door Assy

Item	#	p/n	Description
	1	5067-5415	Door Assy
1	1	5021-1879	Permanent Magnet
2	1		Pressure Spring (not available)
3	2	5067-5412	Hinge Universal
	1	G7167-68718	Light Protection Kit (not shown)

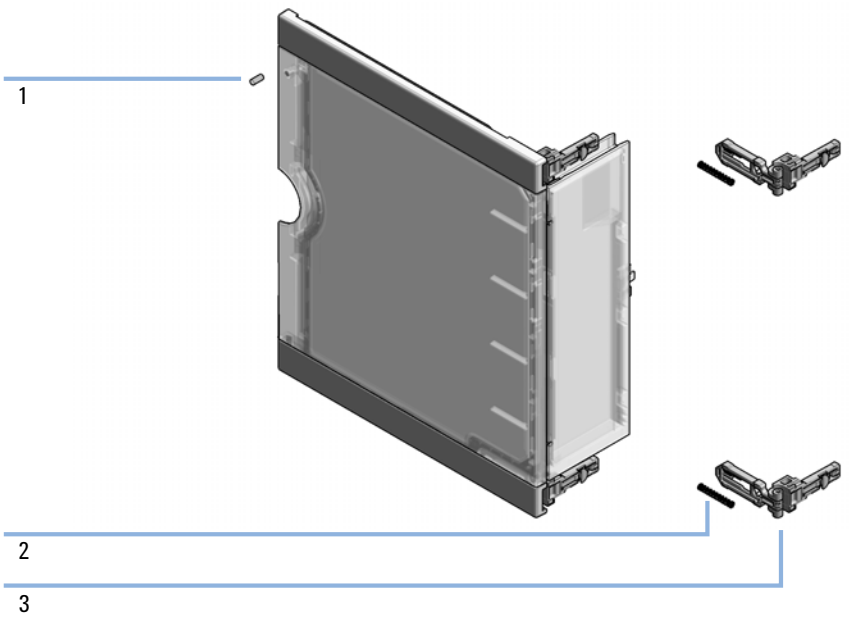


Figure 51 Door assy

Accessory Kit

Item	p/n	Description
	G4267-68705	Accessory Kit
1	G4220-60007	Bottle Head Assembly
2	5063-6527	Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste)
3	5500-1157	Capillary, ST, 0.12 mmx500 mm
4	5043-1013	Tubing Clip
5	5181-1519	CAN cable, Agilent module to module, 1 m

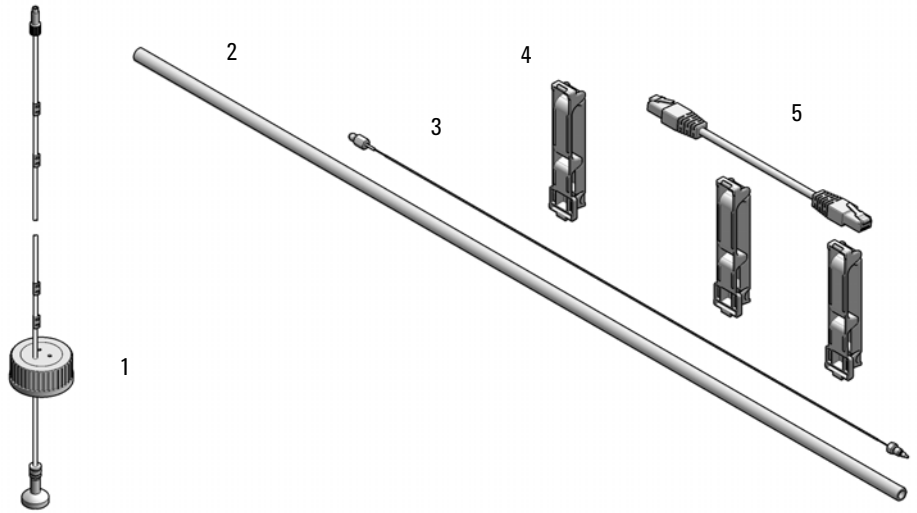


Figure 52 Accessory kit (standard)

Tubing Kit Sampler Standard

Item	p/n	Description
	G4267-60061	Tubing-Kit-Sampler-Standard contains:
1	5042-9974	Tubing Flex (1.5 m)
2	5500-1155	Tube Connector, 90 degree, ID 6.4
3	0890-1760	Tubing Flexible 1 ea / 1 meter
4	5042-6422	Tubing connector, 1 mm o.d.
5	0100-1708	Nut 1/8 PPS
6	0100-1700	FERRULE-AY-18IN
7	0100-1846	UNION-TEFZEL

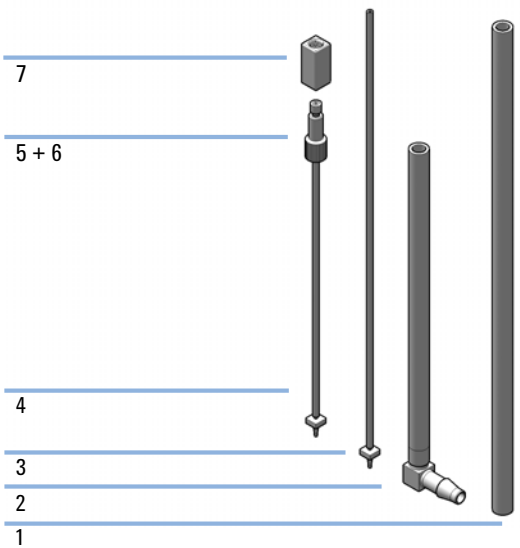


Figure 53 Tubing kit sampler standard

Tubing Kit Sampler Multi-Wash

p/n	Description
	Flex-Tubing
	Flex-Tubing with tube connector 90 °
	FEP Tubing OD 0.0625 with Ferrule/Nut for washport
	FEP Tubing OD 0.0625 with Ferrule/Nut for flushpump

Figure 54 Tubing kit sampler multi-wash

Sample Cooler

Item	p/n	Description
1	G7167-60005	Sample cooler
	G4267-81015	Cable Power Sample Cooler not shown
	G4267-81014	Cable-Ribbon Sample Cooler not shown
	2110-1519	Fuse 3.50 A125 V not shown

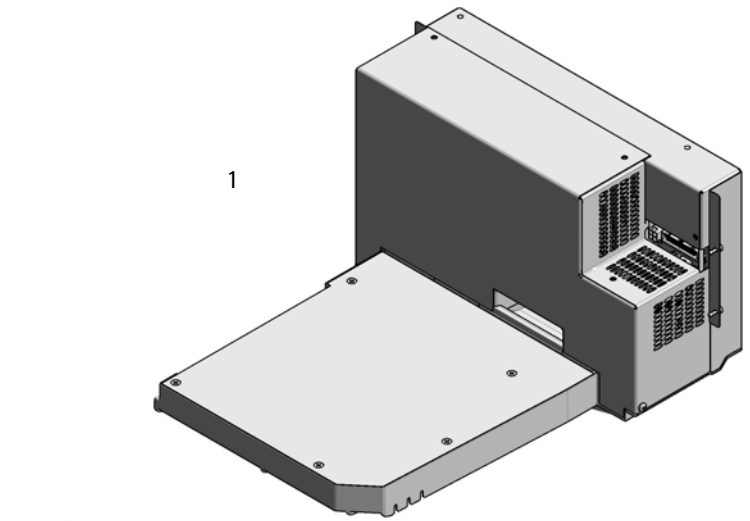


Figure 55 Sample cooler

11
Identifying Cables

Cable Overview 240
Analog Cables 242
Remote Cables 244
CAN/LAN Cables 248
Agilent Module to PC 249
USB 250

This chapter provides information on cables used with the modules.

Cable Overview

NOTE Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

Analog cables

p/n	Description
35900-60750	Agilent 35900A A/D converter
01046-60105	Analog cable (BNC to general purpose, spade lugs)

Remote cables

p/n	Description
5188-8029	ERI to general purpose
5188-8044	Remote Cable ERI – ERI
5188-8045	Remote Cable APG – ERI
5061-3378	Remote Cable to 35900 A/D converter
01046-60201	Agilent module to general purpose

CAN cables

p/n	Description
5181-1516	CAN cable, Agilent module to module, 0.5 m
5181-1519	CAN cable, Agilent module to module, 1 m

LAN cables

p/n	Description
5023-0203	Cross-over network cable, shielded, 3 m (for point to point connection)
5023-0202	Twisted pair network cable, shielded, 7 m (for point to point connection)

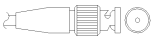
RS-232 cables (not for FUSION board)

p/n	Description
G1530-60600	RS-232 cable, 2 m
RS232-61601	RS-232 cable, 2.5 m Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It's also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9.
5181-1561	RS-232 cable, 8 m

USB cables

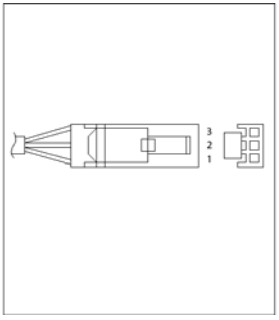
p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)

Analog Cables

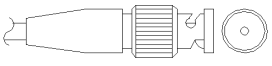


One end of these cables provides a BNC connector to be connected to Agilent modules. The other end depends on the instrument to which connection is being made.

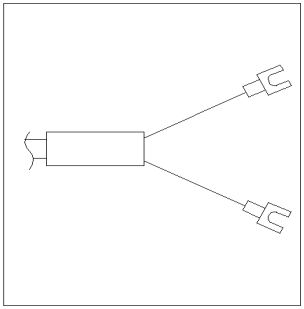
Agilent Module to 35900 A/D converters

p/n 35900-60750	35900	Pin Agilent module	Signal Name
	1		Not connected
	2	Shield	Analog -
	3	Center	Analog +

Agilent Module to BNC Connector

p/n 8120-1840	Pin BNC	Pin Agilent module	Signal Name
	Shield	Shield	Analog -
	Center	Center	Analog +

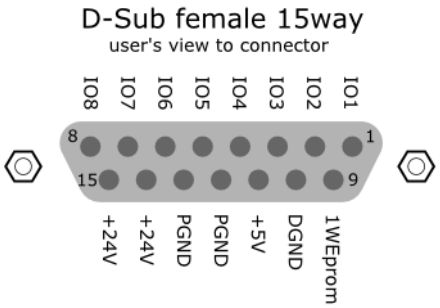
Agilent Module to General Purpose

p/n 01046-60105	Pin	Pin Agilent module	Signal Name
	1		Not connected
	2	Black	Analog -
	3	Red	Analog +

Remote Cables

ERI (Enhanced Remote Interface)

5188-8029 ERI to general purpose

p/n 5188-8029	pin	Color code	Enhanced Remote	Classic Remote	Active (TTL)
	1	white	IO1	START REQUEST	Low
	2	brown	IO2	STOP	Low
	3	green	IO3	READY	High
	4	yellow	IO4	POWER ON	High
	5	grey	IO5	NOT USED	
	6	pink	IO6	SHUT DOWN	Low
	7	blue	IO7	START	Low
	8	red	IO8	PREPARE	Low
	9	black	1wire DATA		
	10	violet	DGND		
	11	grey-pink	+5V ERI out		
	12	red-blue	PGND		
	13	white-green	PGND		
	14	brown-green	+24V ERI out		
	15	white-yellow	+24V ERI out		
	NC	yellow-brown			

5188-8044 ERI to ERI (Connector D_Subminiature 15 pin)

Table 17 5188-8044 ERI to ERI

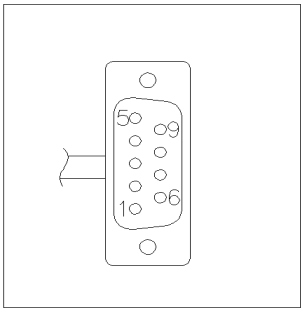
p/n 5188-8044	Pin (ERI)	Signal	Pin (ERI)	Active (TTL)
	10	GND	10	
	1	Start Request	1	Low
	2	Stop	2	Low
	3	Ready	3	High
	5	Power on	5	High
	4	Future	4	
	6	Shut Down	6	Low
	7	Start	7	Low
	8	Prepare	8	Low
	Ground	Cable Shielding	NC	

5188-8045 ERI to APG (Connector D_Subminiature 15 pin (ERI), Connector D_Subminiature 9 pin (APG))

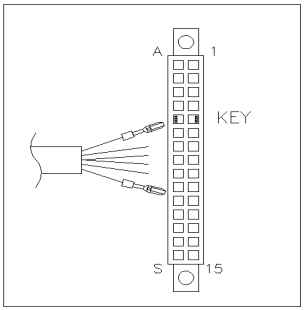
p/n 5188-8045	Pin (ERI)	Signal	Pin (APG)	Active (TTL)
	10	GND	1	
	1	Start Request	9	Low
	2	Stop	8	Low
	3	Ready	7	High
	5	Power on	6	High
	4	Future	5	
	6	Shut Down	4	Low
	7	Start	3	Low
	8	Prepare	2	Low
	Ground	Cable Shielding	NC	

One end of these cables provides a Agilent Technologies APG (Analytical Products Group) remote connector to be connected to Agilent modules. The other end depends on the instrument to be connected to.

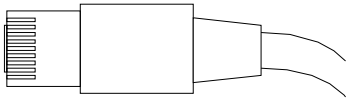
Agilent Module to Agilent 35900 A/D Converters

p/n 5061-3378	Pin 35900 A/D	Pin Agilent module	Signal Name	Active (TTL)
	1 - White	1 - White	Digital ground	
	2 - Brown	2 - Brown	Prepare run	Low
	3 - Gray	3 - Gray	Start	Low
	4 - Blue	4 - Blue	Shut down	Low
	5 - Pink	5 - Pink	Not connected	
	6 - Yellow	6 - Yellow	Power on	High
	7 - Red	7 - Red	Ready	High
	8 - Green	8 - Green	Stop	Low
	9 - Black	9 - Black	Start request	Low

Agilent Module to General Purpose

p/n 01046-60201	Wire Color	Pin Agilent module	Signal Name	Active (TTL)
	White	1	Digital ground	
	Brown	2	Prepare run	Low
	Gray	3	Start	Low
	Blue	4	Shut down	Low
	Pink	5	Not connected	
	Yellow	6	Power on	High
	Red	7	Ready	High
	Green	8	Stop	Low
	Black	9	Start request	Low

CAN/LAN Cables



Both ends of this cable provide a modular plug to be connected to Agilent modules CAN or LAN connectors.

CAN Cables

p/n	Description
5181-1516	CAN cable, Agilent module to module, 0.5 m
5181-1519	CAN cable, Agilent module to module, 1 m

LAN Cables

p/n	Description
5023-0203	Cross-over network cable, shielded, 3 m (for point to point connection)
5023-0202	Twisted pair network cable, shielded, 7 m (for point to point connection)

Agilent Module to PC

p/n	Description
G1530-60600	RS-232 cable, 2 m
RS232-61601	RS-232 cable, 2.5 m Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It's also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9.
5181-1561	RS-232 cable, 8 m

USB

To connect a USB Flash Drive use a USB OTG cable with Mini-B plug and A socket.

p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)

12
Hardware Information

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This chapter describes the module in more detail on hardware and electronics.

Firmware Description

The firmware of the instrument consists of two independent sections:

- a non-instrument specific section, called *resident system*
- an instrument specific section, called *main system*

Resident System

This resident section of the firmware is identical for all Agilent 1100/1200/1220/1260/1290 series modules. Its properties are:

- the complete communication capabilities (CAN, LAN and RS-232C)
- memory management
- ability to update the firmware of the 'main system'

Main System

Its properties are:

- the complete communication capabilities (CAN, LAN and RS-232C)
- memory management
- ability to update the firmware of the 'resident system'

In addition the main system comprises the instrument functions that are divided into common functions like

- run synchronization through APG remote,
- error handling,
- diagnostic functions,
- or module specific functions like
  - internal events such as lamp control, filter movements,
  - raw data collection and conversion to absorbance.

Firmware Updates

Firmware updates can be done using the following tools (latest version should be used):

- Agilent Lab Advisor software with files on the hard disk (*)
- Firmware Update Tool with local files on the hard disk (*)
- Instant Pilot (G4208A) with files on a USB Flash Disk

(*) Required tools, firmware and documentation are available from the Agilent web:
http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761

The file naming conventions are:

PPPP_RVVV_XXX.dlb, where

PPPP is the product number, for example, 1315B for the G1315B DAD,

R the firmware revision, for example, A for G1315B or B for the G1315C DAD,

VVV is the revision number, for example 650 is revision 6.50,

XXX is the build number of the firmware.

For instructions on firmware updates refer to section *Replacing Firmware* in chapter *"Maintenance"* or use the documentation provided with the *Firmware Update Tools*.

NOTE

Update of main system can be done in the resident system only. Update of the resident system can be done in the main system only.

Main and resident firmware must be from the same set.

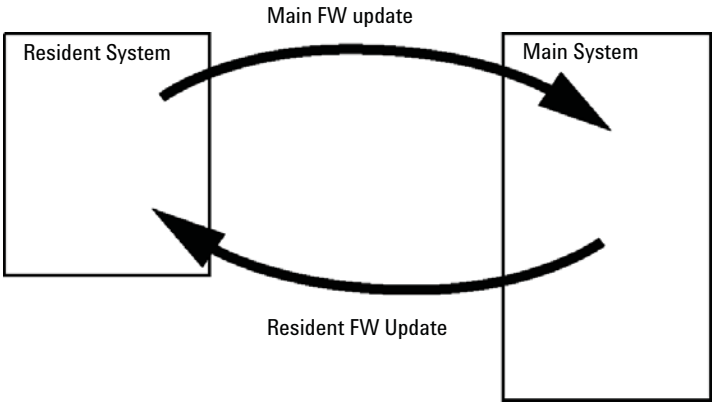


Figure 56 Firmware Update Mechanism

NOTE

Some modules are limited in downgrading due to their main board version or their initial firmware revision. For example, a G1315C DAD SL cannot be downgraded below firmware revision B.01.02 or to a A.xx.xx.

Some modules can be re-branded (e.g. G1314C to G1314B) to allow operation in specific control software environments. In this case the feature set of the target type are use and the feature set of the original are lost. After re-branding (e.g. from G1314B to G1314C), the original feature set is available again.

All these specific informations are described in the documentation provided with the firmware update tools.

The firmware update tools, firmware and documentation are available from the Agilent web.

- http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761

Electrical Connections

- The CAN bus is a serial bus with high-speed data transfer. The two connectors for the CAN bus are used for internal module data transfer and synchronization.
- One analog output provides signals for integrators or data handling systems.
- The ERI/REMOTE connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as start, stop, common shutdown, prepare, and so on.
- With the appropriate software, the LAN connector may be used to control the module from a computer through a LAN connection. This connector is activated and can be configured with the configuration switch.
- With the appropriate software, the USB connector may be used to control the module from a computer through a USB connection.
- The power input socket accepts a line voltage of 100 – 240 VAC ± 10 % with a line frequency of 50 or 60 Hz. Maximum power consumption varies by module. There is no voltage selector on your module because the power supply has wide-ranging capability. There are no externally accessible fuses because automatic electronic fuses are implemented in the power supply.

NOTE Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

Rear view of the module

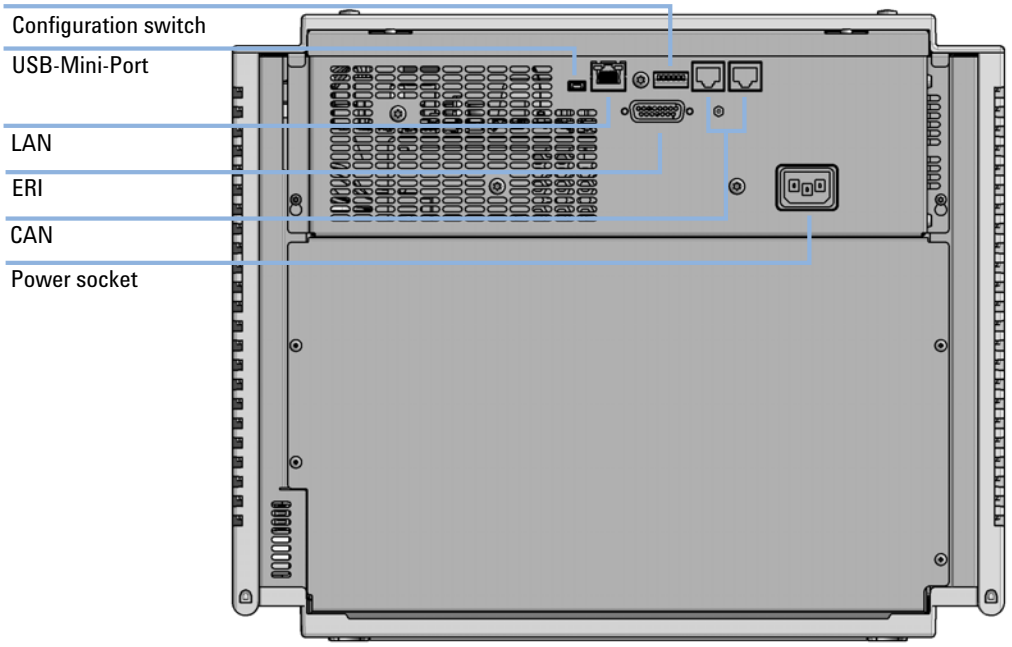


Figure 57 Rear view of multisampler - electrical connections and label

Information on Instrument Serial Number

Serial Number Information 1200 Series and 1290 Infinity

The serial number information on the instrument labels provide the following information:

CCYWWSSSSS	Format
CC	country of manufacturing • DE = Germany • JP = Japan • CN = China
YWW	year and week of last major manufacturing change, e.g. 820 could be week 20 of 1998 or 2008
SSSSS	real serial number

Serial Number Information 1260 Infinity

The serial number information on the instrument labels provide the following information:

CCXZZ00000	Format
CC	Country of manufacturing • DE = Germany • JP = Japan • CN = China
X	Alphabetic character A-Z (used by manufacturing)
ZZ	Alpha-numeric code 0-9, A-Z, where each combination unambiguously denotes a module (there can be more than one code for the same module)
00000	Serial number

Interfaces

The Agilent 1200 Infinity Series II modules provide the following interfaces:

Table 18 Agilent 1200 Infinity II Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Pumps							
G7104A Flexible Pump	2	No	Yes	Yes	1	A	
G7120A High Speed Pump	2	No	Yes	Yes	1	A	
Samplers							
G7129A/B ALS	2	Yes	Yes	No	No	E	
G7167A/B Multisampler	2	Yes	Yes	No	No	E	
Detectors							
G7114A/B VWD	2	Yes	Yes	No	1	E	
G7117A/B DAD	2	Yes	Yes	No	1	E	
G7115A/B DAD	2	Yes	Yes	No	1	E	
Others							
G7116B MCT	2	No	No	No	No	No	Requires a HOST module via CAN

NOTE The detector (DAD/MWD/FLD/VWD/RID) is the preferred access point for control via LAN. The inter-module communication is done via CAN.

- CAN connectors as interface to other modules
- LAN connector as interface to the control software
- RS-232C as interface to a computer
- USB (Universal Series Bus) as interface to a computer
- REMOTE connector as interface to other Agilent products
- Analog output connector(s) for signal output

Overview Interfaces

CAN

The CAN is inter-module communication interface. It is a 2-wire serial bus system supporting high speed data communication and real-time requirement.

LAN

The modules have either an interface slot for an LAN card (e.g. Agilent G1369B/C LAN Interface) or they have an on-board LAN interface (e.g. detectors G1315C/D DAD and G1365C/D MWD). This interface allows the control of the module/system via a PC with the appropriate control software. Some modules have neither on-board LAN nor an interface slot for a LAN card (e.g. G1170A Valve Drive or G4227A Flex Cube). These are hosted modules and require a Host module with firmware B.06.40 or later or with additional G1369C LAN Card.

NOTE If an Agilent detector (DAD/MWD/FLD/VWD/RID) is in the system, the LAN should be connected to the DAD/MWD/FLD/VWD/RID (due to higher data load). If no Agilent detector is part of the system, the LAN interface should be installed in the pump or autosampler.

RS-232C (Serial)

The RS-232C connector is used to control the module from a computer through RS-232C connection, using the appropriate software. This connector can be configured with the configuration switch module at the rear of the module. Refer to *Communication Settings for RS-232C*.

NOTE There is no configuration possible on main boards with on-board LAN. These are pre-configured for

- 19200 baud,
- 8 data bit with no parity and
- one start bit and one stop bit are always used (not selectable).

The RS-232C is designed as DCE (data communication equipment) with a 9-pin male SUB-D type connector. The pins are defined as:

Table 19 RS-232C Connection Table

Pin	Direction	Function
1	In	DCD
2	In	RxD
3	Out	TxD
4	Out	DTR
5		Ground
6	In	DSR
7	Out	RTS
8	In	CTS
9	In	RI

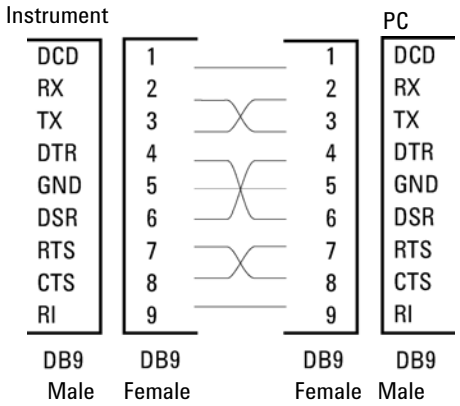


Figure 58 RS-232 Cable

Analog Signal Output

The analog signal output can be distributed to a recording device. For details refer to the description of the module's main board.

APG Remote

The APG Remote connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features as common shut down, prepare, and so on.

Remote control allows easy connection between single instruments or systems to ensure coordinated analysis with simple coupling requirements.

The subminiature D connector is used. The module provides one remote connector which is inputs/outputs (wired- or technique).

To provide maximum safety within a distributed analysis system, one line is dedicated to **SHUT DOWN** the system's critical parts in case any module detects a serious problem. To detect whether all participating modules are switched on or properly powered, one line is defined to summarize the **POWER ON** state of all connected modules. Control of analysis is maintained by signal readiness **READY** for next analysis, followed by **START** of run and optional **STOP** of run triggered on the respective lines. In addition **PREPARE** and **START REQUEST** may be issued. The signal levels are defined as:

- standard TTL levels (0 V is logic true, + 5.0 V is false),
- fan-out is 10,
- input load is 2.2 kOhm against + 5.0 V, and
- output are open collector type, inputs/outputs (wired- or technique).

NOTE All common TTL circuits operate with a 5 V power supply. A TTL signal is defined as "low" or L when between 0 V and 0.8 V and "high" or H when between 2.0 V and 5.0 V (with respect to the ground terminal).

Table 20 Remote Signal Distribution

Pin	Signal	Description
1	DGND	Digital ground
2	PREPARE	(L) Request to prepare for analysis (for example, calibration, detector lamp on). Receiver is any module performing pre-analysis activities.
3	START	(L) Request to start run / timetable. Receiver is any module performing run-time controlled activities.
4	SHUT DOWN	(L) System has serious problem (for example, leak: stops pump). Receiver is any module capable to reduce safety risk.
5		Not used
6	POWER ON	(H) All modules connected to system are switched on. Receiver is any module relying on operation of others.
7	READY	(H) System is ready for next analysis. Receiver is any sequence controller.
8	STOP	(L) Request to reach system ready state as soon as possible (for example, stop run, abort or finish and stop injection). Receiver is any module performing run-time controlled activities.
9	START REQUEST	(L) Request to start injection cycle (for example, by start key on any module). Receiver is the autosampler.

Special Interfaces

There is no special interface for this module.

ERI (Enhanced Remote Interface)

ERI replaces the AGP Remote Interface that is used in the HP 1090/1040/1050/1100 HPLC systems and Agilent 1100/1200/1200 Infinity HPLC modules. All new 1200 Infinity II products using the FUSION core electronics use ERI. This interface is already used in the Agilent Universal Interface Box 2 (UIB2)

ERI Description

The ERI interface contains eight individual programmable input/output pins. In addition, it provides 24 V power and 5 V power and a serial data line to detect and recognize further add-ons that could be connected to this interface. This way the interface can support various additional devices like sensors, triggers (in and out) and small controllers, etc.

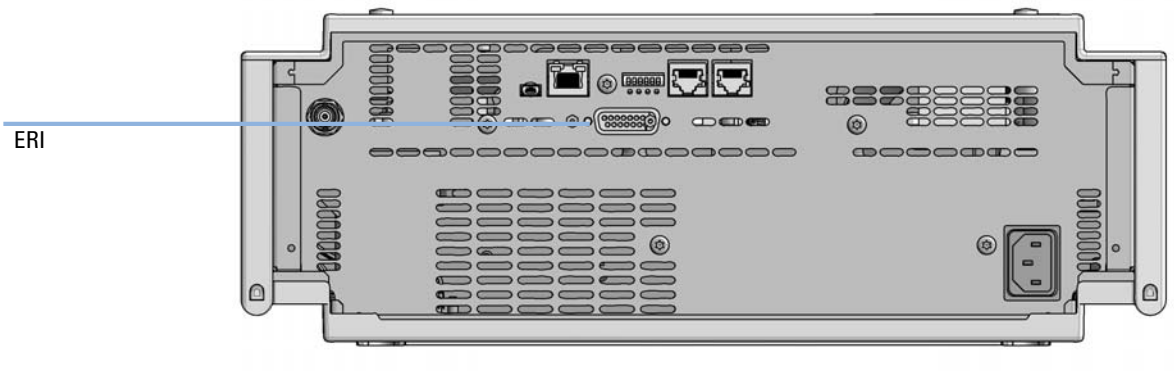
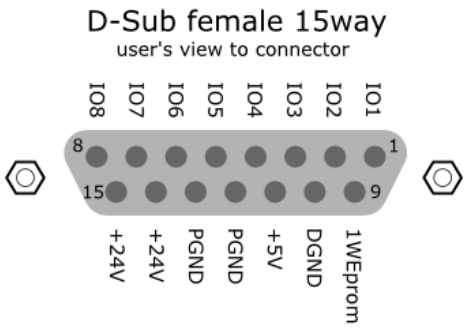


Figure 59 Location of the ERI interface (example shows a G7114A/B VWD)



Pin	Enhanced Remote
1	IO 1 (START REQUEST)
2	IO 2 (STOP)
3	IO 3 (READY)
4	IO 4 (POWER ON)
5	IO 5 (NOT USED)
6	IO 6 (SHUT DOWN)
7	IO 7 (START)
8	IO 8 (PREPARE)
9	1 wire DATA
10	DGND
11	+5 V ERI out
12	PGND
13	PGND
14	+24 V ERI out
15	+24 V ERI out

IO (Input/Output) Lines

- Eight generic bi-directional channels (input or output).
- Same as the APG Remote.
- Devices like valves, relays, ADCs, DACs, controllers can be supported/controlled.

1-Wire Data (Future Use)

This serial line can be used to read out an EPROM or write into an EPROM of a connected ERI-device. The firmware can detect the connected type of device automatically and update information in the device (if required).

5V Distribution (Future Use)

- Available directly after turn on oft the hosting module (assures that certain base functionality of the device can be detected by firmware).
- For digital circuits or similar.
- Provided 500 mA maximum.
- Short-circuit proof with automatic switch off (by firmware).

24V Distribution (Future Use)

- Available by firmware command (defined turn on/off).
- For devices that need higher power
  - Class 0: 0.5 A maximum (12 W)
  - Class 1: 1.0 A maximum (24 W)
  - Class 2: 2.0 A maximum (48 W)
- Class depends on hosting module's internal power overhead.
- If a connected device requires more power the firmware detects this (overcurrent detection) and provides the information to the user interface.
- Fuse used for safety protection (on board).
- Short circuit will be detected through hardware.

Setting the 6-bit Configuration Switch

The 6-bit configuration switch is located at the rear of the module with FUSION electronics. Switch settings provide configuration parameters for LAN and instrument specific initialization procedures.

All modules with FUSION electronics:

- Default is ALL switches DOWN (best settings).
  - Default IP address for LAN 192.168.254.11
- For specific LAN modes switches 4-5 must be set as required.
- For boot resident/cold start modes switches 1+2 or 6 must be UP.

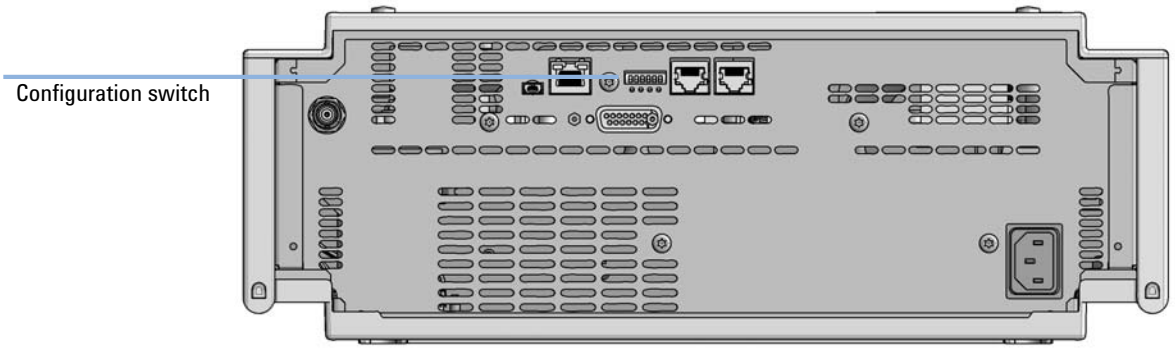


Figure 60 Location of Configuration switch (example shows a G7114A/B VWD)

Table 21 6-bit Configuration Switch

	Mode	Function/Setting				
	Switch 1	**Switch 2**	**Switch 3**	**Switch 4**	**Switch 5**	**Switch 6**
COM[1]	**0**	n.a.[2]	n.a.	LAN Init Mode		n.a.
Use Default IP Address[3]		0	0	0	0	0
Use Stored IP Address		0	0	0	1	0
Use DHCP to request IP Address[4]		0	0	1	0	0
Test	**1**	**System**	**n.a.**	**n.a.**	**n.a.**	**ColdStart**
Boot Main System / Keep Data		0	0	0	0	0
Boot Resident System / Keep Data		1	0	0	0	0
Boot Main System / Revert to Default Data		0	0	0	0	1
Boot Resident System / Revert to Default Data		1	0	0	0	1

1 When selecting mode COM, settings are stored to non-volatile memory. When selecting mode TEST, COM settings are taken from non-volatile memory.

2 not assigned - Always keep these switches on position '0' (off)

3 Default IP Address is 192.168.254.11

4 Host Name will be the MAC address.

Instrument Layout

The industrial design of the module incorporates several innovative features. It uses Agilent's E-PAC concept for the packaging of electronics and mechanical assemblies. This concept is based upon the use of expanded polypropylene (EPP) layers of foam plastic spacers in which the mechanical and electronic boards components of the module are placed. This pack is then housed in a metal inner cabinet which is enclosed by a plastic external cabinet. The advantages of this packaging technology are:

- virtual elimination of fixing screws, bolts or ties, reducing the number of components and increasing the speed of assembly/disassembly,
- the plastic layers have air channels molded into them so that cooling air can be guided exactly to the required locations,
- the plastic layers help cushion the electronic and mechanical parts from physical shock, and
- the metal inner cabinet shields the internal electronics from electromagnetic interference and also helps to reduce or eliminate radio frequency emissions from the instrument itself.

Early Maintenance Feedback

Maintenance requires the exchange of components which are subject to wear or stress. Ideally, the frequency at which components are exchanged should be based on the intensity of usage of the module and the analytical conditions, and not on a predefined time interval. The early maintenance feedback (**EMF**) feature monitors the usage of specific components in the instrument, and provides feedback when the user-selectable limits have been exceeded. The visual feedback in the user interface provides an indication that maintenance procedures should be scheduled.

EMF Counters

EMF counters increment with use and can be assigned a maximum limit which provides visual feedback in the user interface when the limit is exceeded. Some counters can be reset to zero after the required maintenance procedure.

Using the EMF Counters

The user-settable **EMF** limits for the **EMF Counters** enable the early maintenance feedback to be adapted to specific user requirements. The useful maintenance cycle is dependent on the requirements for use. Therefore, the definition of the maximum limits need to be determined based on the specific operating conditions of the instrument.

Setting the EMF Limits

The setting of the **EMF** limits must be optimized over one or two maintenance cycles. Initially the default **EMF** limits should be set. When instrument performance indicates maintenance is necessary, take note of the values displayed by the **EMF counters**. Enter these values (or values slightly less than the displayed values) as **EMF** limits, and then reset the **EMF counters** to zero. The next time the **EMF counters** exceed the new **EMF** limits, the **EMF** flag will be displayed, providing a reminder that maintenance needs to be scheduled.

13
LAN Configuration

Setting up the module in a LAN environment 272
Connecting the module via LAN 273

This chapter provides information on connecting the detector to the Agilent ChemStation PC.

Setting up the module in a LAN environment

It is not recommended to connect a system via an autosampler. The detector is producing the most data in the stack, followed by the pump, and it is therefore highly recommended to use either of these modules for the LAN connection.

Connecting the module via LAN

If the module is being operated as a standalone module or if a connection via LAN is required regardless of above mentioned recommendation, a G1369B/C LAN card has to be used. For installation and configuration, see the G1369B/C documentation.

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Appendix

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Agilent Technologies on Internet 288

This chapter provides addition information on safety, legal and web.

General Safety Information

General Safety Information

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

WARNING

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

➔ The operator of this instrument is advised to use the equipment in a manner as specified in this manual.

Safety Standards

This is a Safety Class I instrument (provided with terminal for protective earthing) and has been manufactured and tested according to international safety standards.

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Before Applying Power

WARNING

Wrong voltage range, frequency or cabling

Personal injury or damage to the instrument

- ➔ Verify that the voltage range and frequency of your power distribution matches to the power specification of the individual instrument.
- ➔ Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.
- ➔ Make all connections to the unit before applying power.

NOTE

Note the instrument's external markings described under "Symbols" on page 280.

Ground the Instrument

WARNING

Missing electrical ground

Electrical shock

- ➔ If your product is provided with a grounding type power plug, the instrument chassis and cover must be connected to an electrical ground to minimize shock hazard.
- ➔ The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

WARNING

Presence of flammable gases or fumes

Explosion hazard

➔ Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

WARNING

Instrument covers removed

Electrical shock

➔ Do Not Remove the Instrument Cover

➔ Only Agilent authorized personnel are allowed to remove instrument covers. Always disconnect the power cables and any external circuits before removing the instrument cover.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Agilent Sales and Service Office for service and repair to ensure that safety features are maintained.

In Case of Damage

WARNING

Damage to the module

Personal injury (for example electrical shock, intoxication)

➔ Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Solvents

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

The handling of solvents, samples and reagents can hold health and safety risks.

- ➔ When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.
- ➔ The volume of substances should be reduced to the minimum required for the analysis.
- ➔ Do not operate the instrument in an explosive atmosphere.
- ➔ Never exceed the maximal permissible volume of solvents (6 L) in the solvent cabinet.
- ➔ Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.
- ➔ Arrange the bottles as specified in the usage guideline for the solvent cabinet.
- ➔ A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet.
- ➔ Ground the waste container.
- ➔ The residual free volume in the appropriate waste container must be large enough to collect the waste liquid.
- ➔ Check the filling level of the waste container regularly.
- ➔ To achieve maximal safety, check the correct installation regularly.
- ➔ Do not use solvents with an auto-ignition temperature below 200 °C (392 °F).

Symbols

Table 22 Symbols

	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect risk of harm to the operator and to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.
	Cooling unit is designed as vapor-compression refrigeration system. Contains fluorinated greenhouse gas (refrigerant) according to the Kyoto protocol. For specifications of refrigerant, charge capacity, carbon dioxide equivalent (CDE), and global warming potential (GWP) see instrument label.
	Confirms that a manufactured product complies with all applicable European Community directives. The European Declaration of Conformity is available at: http://regulations.corporate.agilent.com/DoC/search.htm
	Manufacturing date.
	Power symbol indicates On/Off. The apparatus is not completely disconnected from the mains supply when the power switch is in the Off position
	Pacemaker Magnets could affect the functioning of pacemakers and implanted heart defibrillators. A pacemaker could switch into test mode and cause illness. A heart defibrillator may stop working. If you wear these devices keep at least 55 mm distance to magnets. Warn others who wear these devices from getting too close to magnets.

Table 22 Symbols

	Magnetic field Magnets produce a far-reaching, strong magnetic field. They could damage TVs and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids and speakers. Keep magnets at least 25 mm away from devices and objects that could be damaged by strong magnetic fields.
	Indicates a pinching or crushing hazard
	Indicates a piercing or cutting hazard.

WARNING

A WARNING

alerts you to situations that could cause physical injury or death.

➔ Do not proceed beyond a warning until you have fully understood and met the indicated conditions.

CAUTION

A CAUTION

alerts you to situations that could cause loss of data, or damage of equipment.

➔ Do not proceed beyond a caution until you have fully understood and met the indicated conditions.

Waste Electrical and Electronic Equipment Directive

Abstract

The Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC), adopted by EU Commission on 13 February 2003, is introducing producer responsibility on all electric and electronic appliances starting with 13 August 2005.

NOTE

This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category:

With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a Monitoring and Control Instrumentation product.

NOTE

Do not dispose of in domestic household waste

To return unwanted products, contact your local Agilent office, or see http://www.agilent.com for more information.

Refrigerant

The refrigerant HFC- 134a is used only in the Agilent Infinity II Sample Cooler.

Table 23 Physical properties of refrigerant HFC-134a

Molecular weight	102
Critical temperature	101.1 °C
Critical pressure	40.6 bar
Boiling point	-26.5 °C

WARNING

Refrigerant

Refrigerant HFC-134a is known as a safe refrigerant, however accidents can occur if it is handled incorrectly. For this reason, the following instructions must be observed:

- ➔ Avoid contact with liquid refrigerant HFC-134a. At atmospheric pressure HFC-134a evaporates at approximately -26 °C and causes frost bite.
- ➔ After skin contact, rinse the affected area with water.
- ➔ After eye contact, rinse the eye(s) with plenty of water for at least 15 minutes and consult a doctor.
- ➔ HFC-134a must not be allowed to escape in enclosed areas. Although HFC-134a is not toxic, there is a danger of suffocation as gaseous refrigerant is heavier than air.
- ➔ Please observe the following first aid instructions. After inhalation, move the affected person to fresh air, keep him warm and allow him to rest. If necessary, he should be supplied with oxygen. If he has stopped breathing or is breathing erratically, he should be given artificial respiration. In the case of cardiac arrest, carry out heart massage. Send for a doctor immediately.
- ➔ Moreover, it must be noted that HFC-134a must always be extracted from the system and collected. It must never be discharged into the atmosphere on environmental grounds (greenhouse effect).

CAUTION

General hazards and improper disposal

Improper disposal of the media and components used pollutes the environment.

- ➔ The breakdown of the sample cooler unit must be carried out by specialist refrigeration company.
- ➔ All media must be disposed of in accordance with national and local regulations.
- ➔ Please contact your local Agilent Service Center in regard to safe environmental disposal of the appliance or check www.agilent.com for more info.

Radio Interference

Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

Test and Measurement

If test and measurement equipment is operated with equipment unscreened cables and/or used for measurements on open set-ups, the user has to assure that under operating conditions the radio interference limits are still met within the premises.

Sound Emission

Manufacturer's Declaration

This statement is provided to comply with the requirements of the German Sound Emission Directive of 18 January 1991.

This product has a sound pressure emission (at the operator position) < 70 dB.

- Sound Pressure Lp < 70 dB (A)
- At Operator Position
- Normal Operation
- According to ISO 7779:1988/EN 27779/1991 (Type Test)

Solvent Information

Observe the following recommendations on the use of solvents.

- Brown glass ware can avoid growth of algae.
- Avoid the use of the following steel-corrosive solvents:
  - Solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on),
  - High concentrations of inorganic acids like sulfuric acid and nitric acid, especially at higher temperatures (if your chromatography method allows, replace by phosphoric acid or phosphate buffer which are less corrosive against stainless steel),
  - Halogenated solvents or mixtures which form radicals and/or acids, for example:

    $2CHCl_3 + O_2 \rightarrow 2COCl_2 + 2HCl$

    This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol,
  - Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropyl ether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides,
  - Solvents containing strong complexing agents (e.g. EDTA),
  - Mixtures of carbon tetrachloride with 2-propanol or THF.

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http://www.agilent.com

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In This Book

This manual contains technical reference information about the Agilent 1290 Infinity II Multisampler (G7167B) and the Agilent 1260 Infinity Multisampler (G7167A).

The manual describes the following:

- Introduction,
- Site requirements and specifications,
- Using the module,
- Preparing the module,
- Optimizing performance,
- Troubleshooting and diagnostics,
- Error information,
- Test functions,
- Maintenance,
- Parts,
- Hardware information,
- LAN configuration,
- Safety and related information.

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